FURUNO

OPERATOR'S MANUAL

DOPPLER SONAR

MODEL **DS-60**

FURUNO ELECTRIC CO., LTD.

www.furuno.co.jp

ECF

(Elemental Chlorine Free)

The paper used in this manual is elemental chlorine free.

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IMPORTANT NOTICES

General

- This manual has been authored with simplified grammar, to meet the needs of international users.
- The operator of this equipment must read and follow the descriptions in this manual. Wrong operation or maintenance can cancel the warranty or cause injury.
- Do not copy any part of this manual without written permission from FURUNO.
- If this manual is lost or worn, contact your dealer about replacement.
- The contents of this manual and equipment specifications can change without notice.
- The example screens (or illustrations) shown in this manual can be different from the screens you see on your display. The screens you see depend on your system configuration and equipment settings.
- Save this manual for future reference.
- Any modification of the equipment (including software) by persons not authorized by FURUNO will cancel the warranty.
- All brand and product names are trademarks, registered trademarks or service marks of their respective holders.

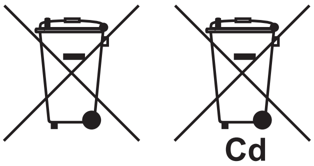
How to discard this product

Discard this product according to local regulations for the disposal of industrial waste. For disposal in the USA, see the homepage of the Electronics Industries Alliance (http://www.eiae.org/) for the correct method of disposal.

How to discard a used battery

Some FURUNO products have a battery(ies). To see if your product has a battery, see the chapter on Maintenance. Follow the instructions below if a battery is used. Tape the + and - terminals of battery before disposal to prevent fire, heat generation caused by short circuit..

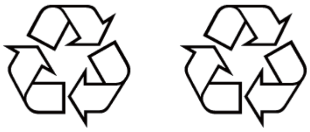
In the European Union



Cd

The crossed-out trash can symbol indicates that all types of batteries must not be discarded in standard trash, or at a trash site. Take the used batteries to a battery collection site according to your national legislation and the Batteries Directive 2006/66/EU.

In the USA



Ni-Cd Pb

The Mobius loop symbol (three chasing arrows) indicates that Ni-Cd and lead-acid rechargeable batteries must be recycled. Take the used batteries to a battery collection site according to local laws.

In the other countries

There are no international standards for the battery recycle symbol. The number of symbols can increase when the other countries make their own recycle symbols in the future.

SAFETY INSTRUCTIONS

Please read these safety instructions before you operate the equipment.

WARNING	Indicates a condition that can cause death or serious injury if not avoided.
CAUTION	Indicates a condition that can cause minor or moderate injury if not avoided.

Warning, Caution — Prohibitive Action — Mandatory Action

WARNING

Do not open the equipment.

This equipment uses high voltage that can cause electrical shock.
Only qualified persons can work inside the equipment.

Turn off power at the switchboard if something is dropped inside the equipment or water leaks into the equipment.

Fire or electrical shock can result if the power remains on.

Turn off the power at the switchboard if the equipment is emitting smoke or fire.

Fire or electrical shock can result if the power remains on.

Do not disassemble or modify the equipment.

Fire, electrical shock or bodily injury can result.

WARNING

Do not put liquid-filled containers on or near the equipment.

Fire or electrical shock can result if a liquid spills into the equipment.

Do not operate the equipment with wet hands.

Fire or electrical shock can result.

If you feel the equipment is abnormal or is giving off strange noises, turn off the power at the switchboard immediately. Contact a FURUNO agent or dealer for advice.

Do not allow rain or water splash to get into the equipment.

Fire or electrical shock can result.

Use the correct fuse.

Use of a wrong fuse can cause bodily injury or fire.

⚠ CAUTION

If an LCD-type display is used, handle the display with care.

The panel is made of glass which, if broken, can cause injury.

Do not paint the transducer .

Paint causes a large drop in sensitivity.

Do not power the equipment when the transducer is in air.

The transducer can become damaged.

Remove marine life from the face of the transducer when the ship is dry-docked.

Marine life can affect sensitivity.

⚠ CAUTION

If the optional rate gyro is installed, power the system when the ship is stationary or is traveling in a straight line.

The point of reference for the rate gyro is determined when the system is powered. If the ship is turning at that time, the point of reference will be wrong and the gyro indication in error. When the rate gyro goes off (power outage, etc.), make sure the ship is stationary or traveling in a straight line before turning on the rate gyro.

Warning Label

Warning label(s) is(are) attached to the equipment. Do not remove the label(s). If a label is missing or damaged, contact a FURUNO agent or dealer about replacement.

⚠ WARNING ⚠

To avoid electrical shock, do not remove cover. No user-serviceable parts inside.

⚠ 警 告 ⚠

感電の恐れあり。
サービスマン以外の方はカバーを開けないで下さい。内部には高電圧部分が数多くあり、万一さわると危険です。

Name: Warning Label (1)
Type: 86-003-1011-3
Code No.: 100-236-233-10

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FOREWORD

A Word to the Owner of the DS-60

Congratulations on your choice of the DS-60 Doppler Sonar. We are confident you will see why the FURUNO name has become synonymous with quality and reliability.

For over 60 years FURUNO Electric Company has enjoyed an enviable reputation for innovative and dependable marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

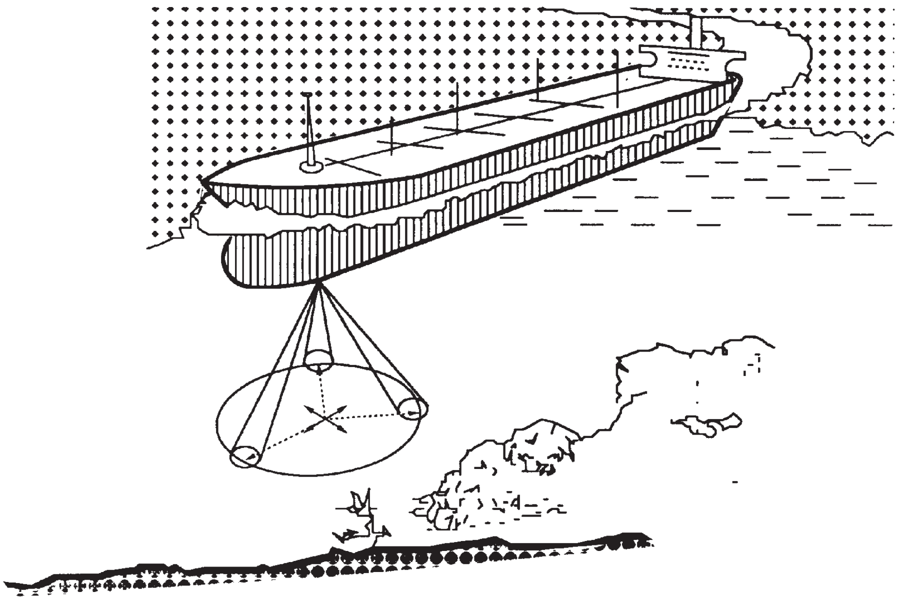
Your equipment is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properly operated and maintained. Please carefully read and follow the operation and maintenance procedures set forth in this manual.

Thank you for considering and purchasing FURUNO.

Features

The DS-60 is a high precision Doppler Sonar designed for use on VLCC, LNG, LPG, container ships, cargo ships, etc. The DS-60 measures speeds relative to ground and water in the fore, stern and transverse directions. This arrangement provides for precision docking of tankers and the like to loading and unloading facilities, as well as safe navigation in narrow channels and straits.

- Meets the requirements of IEC 61023 Ed 3.0, IEC 60945 Ed 4th.
- Measurement accuracy of ±0.01 m/s.
- Ground tracking from 1-200 m for accurate ground speed in coastal waters.
- Sub display units (max. 5) for display on the wing, etc.

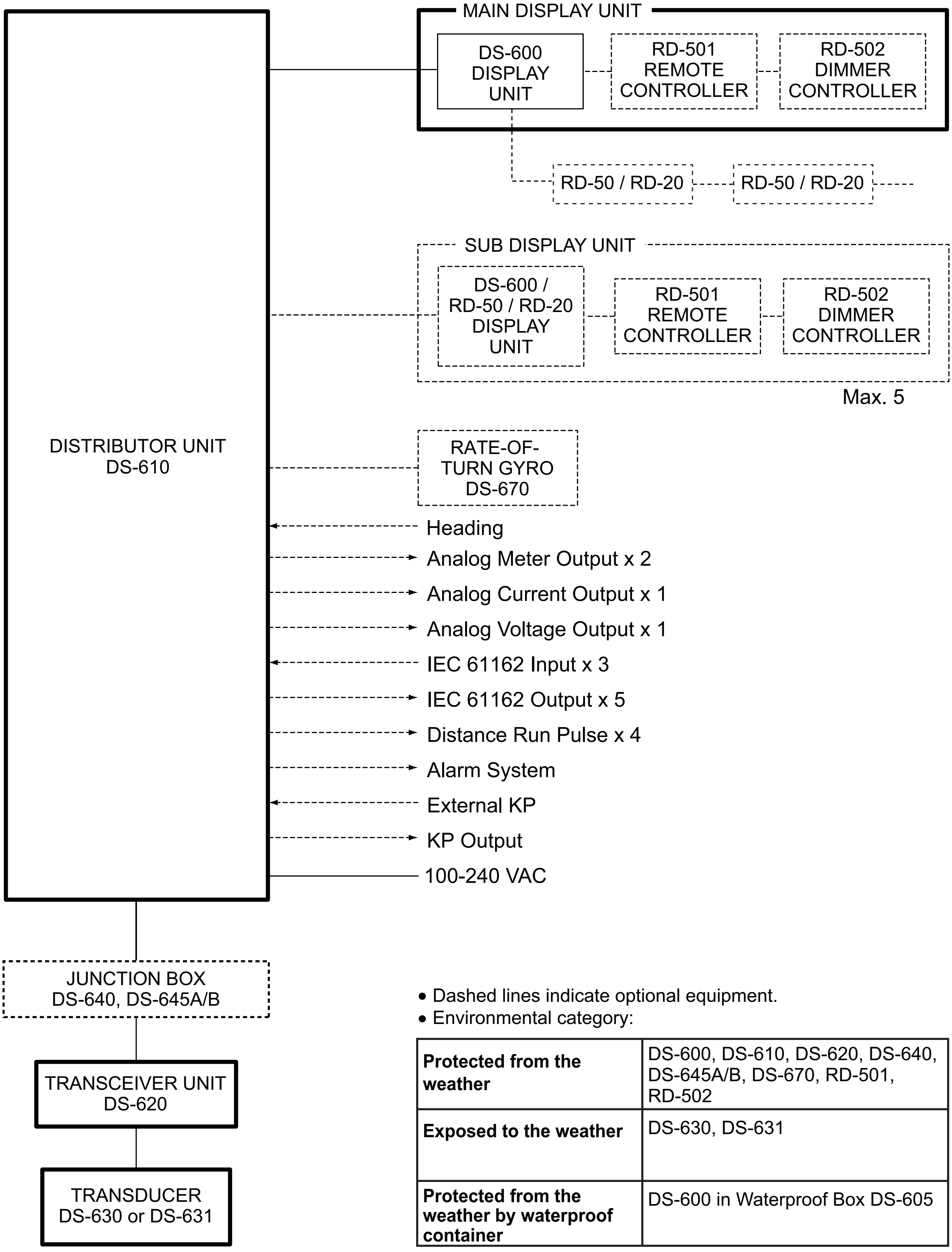


Program Numbers

Unit, Program	Number	Date of Modification
DS-600		
Starter	6652000-01.xx	March 2010
Booter	6652001-02.xx	March 2010
Main	6652002-02.xx	March 2010
DS-610		
Starter	6652100-01.xx	March 2010
Booter	6652101-02.xx	March 2010
Main	6652102-02.xx	March 2010
FPGA	6652103-00.xx	March 2010
DS-620		
Starter	6652200-01.xx	March 2010
Booter	6652201-02.xx	March 2010
Main	6652202-02.xx	March 2010
FPGA1	6652203-00.xx	March 2010
FPGA2	6652204-00.xx	March 2010
RD-501, RD-502		
2651009-01.xx		August 2009

xx=minor change

SYSTEM CONFIGURATION



- Dashed lines indicate optional equipment.
- Environmental category:

Protected from the weather	DS-600, DS-610, DS-620, DS-640, DS-645A/B, DS-670, RD-501, RD-502
Exposed to the weather	DS-630, DS-631
Protected from the weather by waterproof container	DS-600 in Waterproof Box DS-605

1. INTRODUCTION

This chapter provides the information necessary to get you started with the system.

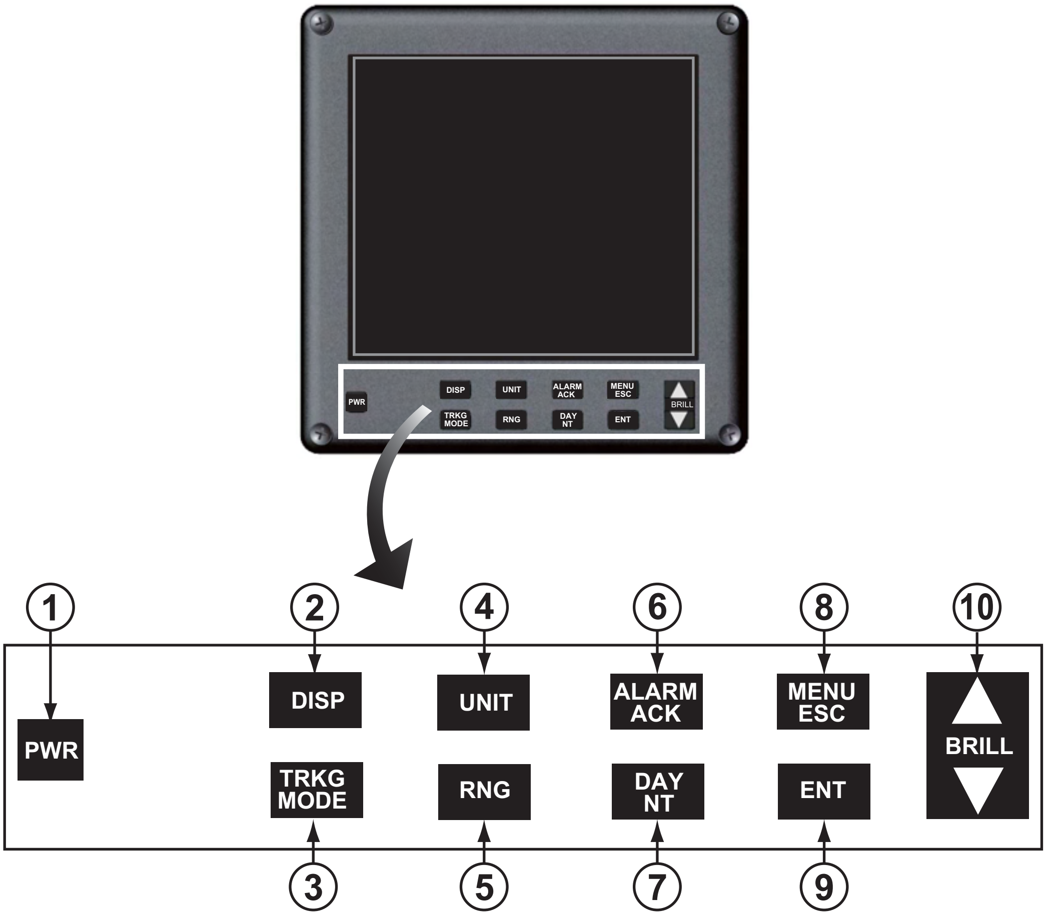
The display unit has ten keys that respond immediately to your command. When you operate a key, a single beep sounds. If you do not need the beep, you can deactivate the beep from the menu.

Standards used in this manual

The control names are shown in bold face, for example, "**DISP** key". Menu-related items are in brackets, for example, [Key Beep].

1.1 Controls

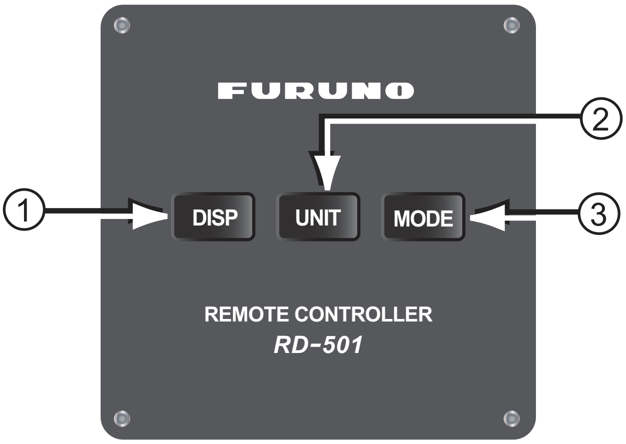
1.1.1 Display Unit DS-600



No.	Control	Function
1	PWR	Turn the power on and off.
2	DISP	• Select a display. • Close the menu and return to last-used display. • In multiple data displays, select a data indication to change its unit of measurement (with the **UNIT** key).

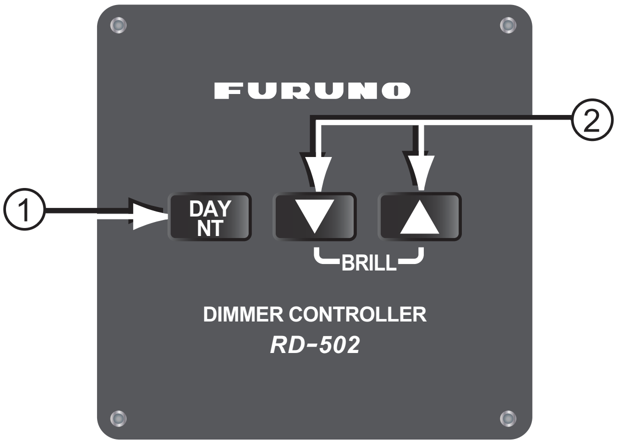
No.	Control	Function
3	TRKG MODE	• **Main display unit:** Select the tracking mode (water, ground, or auto) for the measurement of ship's speed. • **Sub display unit:** Select the tracking mode to ground tracking or water tracking when the tracking mode at the main display unit is ground tracking.
4	UNIT	Select the unit of measurement for speed, depth, distance, current (tide) speed, wind speed, etc.
5	RNG	Select the range in the berthing and echo monitor displays.
6	ALARM ACK	Stop the audible alarm.
7	DAY/NT	Select the daytime and nighttime displays alternately.
8	MENU/ESC	• Open the menu. • Return control to the menu window without making any changes at the menu options window. • Select the item to change its unit of measurement in multiple data displays. • Close the menu when the menu window is active.
9	ENT	• Confirm an operation in menu operation. • Long-push to hide or show nav data and 3-axis speed data in the berthing mode. • Long-push to reset the trip distance on the displays that show trip distance.
10	BRILL	• Adjust the screen brilliance. ▼ to decrease the brilliance, ▲ to increase the brilliance. • Move the cursor in menu operation.

1.1.2 Remote Controller RD-501 (option)



No.	Control	Function
1	DISP	• Select a display. • Close the menu and return to last-used display. • In multiple data displays, select a data indication to change its unit of measurement (with the **UNIT** key).
2	UNIT	Select the unit of measurement for speed, depth, distance, current (tide) speed, wind speed, etc.
3	MODE	• **Main display unit:** Select the tracking mode (ground, water, or auto) for the measurement of ship speed. • **Sub display unit:** Select the tracking mode to ground tracking or water tracking when the tracking mode at the main display unit is ground tracking.

1.1.3 Dimmer Controller RD-502 (option)



No.	Control	Function
1	DAY/NT	Select the daytime and nighttime displays alternately.
2	▼, ▲	Adjust the screen brilliance. ▼ to decrease the brilliance, ▲ to increase the brilliance. To quickly increase or decrease the brilliance, press and hold the related key.

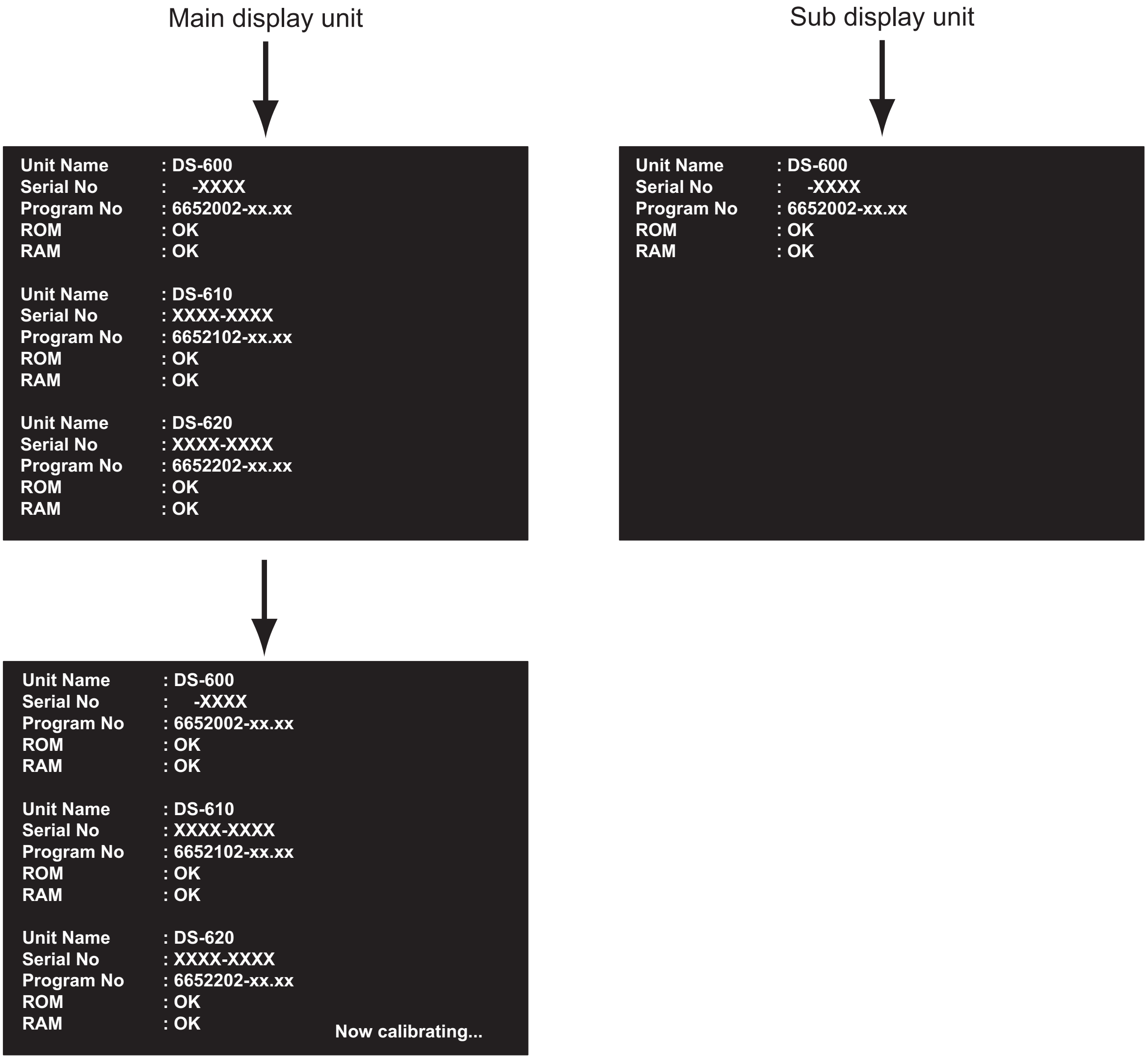
1.2 How to Turn the Power On and Off

Press the **PWR** key to turn on the power.

The main display unit shows the serial numbers, program numbers and results of the RAM and ROM checks (OK or NG) for the Display Unit DS-600, Distributor Unit DS-610, and Transceiver Unit DS-620. The sub display unit shows its serial number, program number and results of the ROM and RAM check, "OK" or "NG" (No Good.) After the program numbers appear and the test results are displayed, “Now calibrating...” is displayed momentarily on the main display unit, the start-up screen is erased, then the last-used display appears.

Note: If "NG" appears as the RAM or ROM check result, the equipment stops. Reset the power to try to restore normal operation. If you cannot restore normal operation, contact a FURUNO agent or dealer for instruction.

To turn off the power, press the **PWR** key.



Note: The screen refreshes slower in low ambient temperature.

1.3 How to Adjust the Screen Brilliance

You can adjust the brilliance of the display screen from the display unit and the Dimmer Controller, in 10 levels including off. Press ▲ to increase the brilliance, or press ▼ to decrease the brilliance. To quickly change the brilliance, press and hold related arrow.

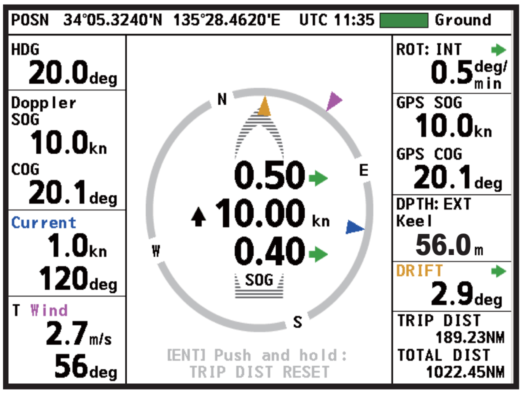
If the Remote Display RD-50 (sub display unit) is connected to the display unit of the DS-60 in a daisy chain, their brilliances are mutually adjusted when you adjust the brilliance from the DS-60.

1.4 How to Select a Display

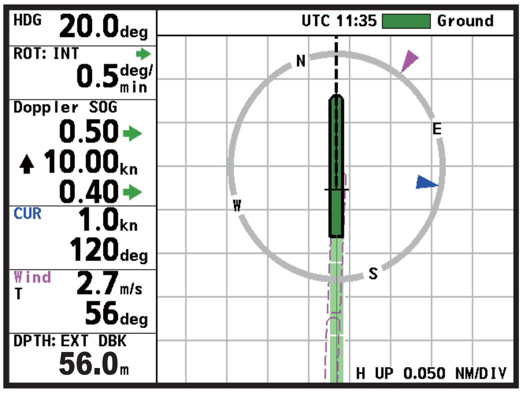
Press the **DISP** key to select a display. In the default arrangement there are four displays: navigation data, berthing (head-up), heading and speed, and trip distance and total distance.

A maximum of seven displays are available, in full screen or two-way horizontal split screen. Section 5.1 shows you to set the displays to meet your requirements.

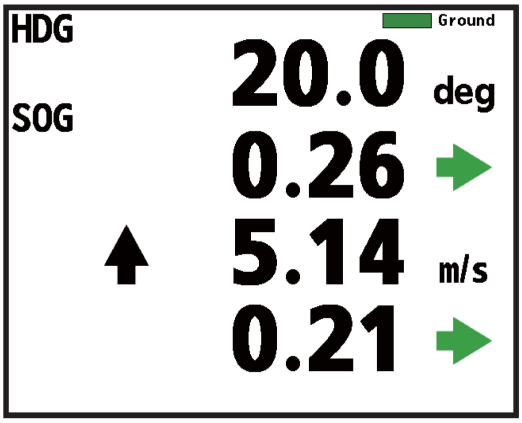
When a data is lost, hyphens; for example, "- -.-", replace the lost data. When a data is in error, its unit (kn, etc.) is shown in white characters on a red background. The "normal" unit appears again when the data returns.



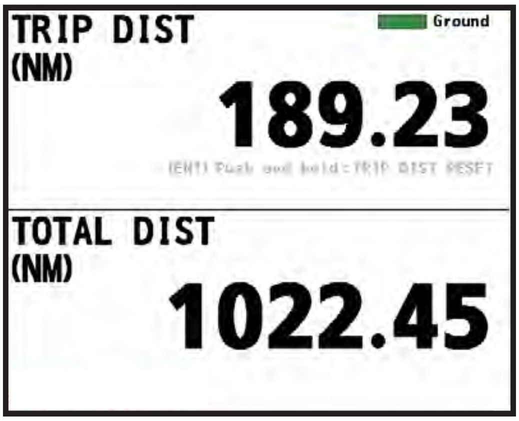
Navigation data display



Berthing display (head-up)



Heading, speed data display



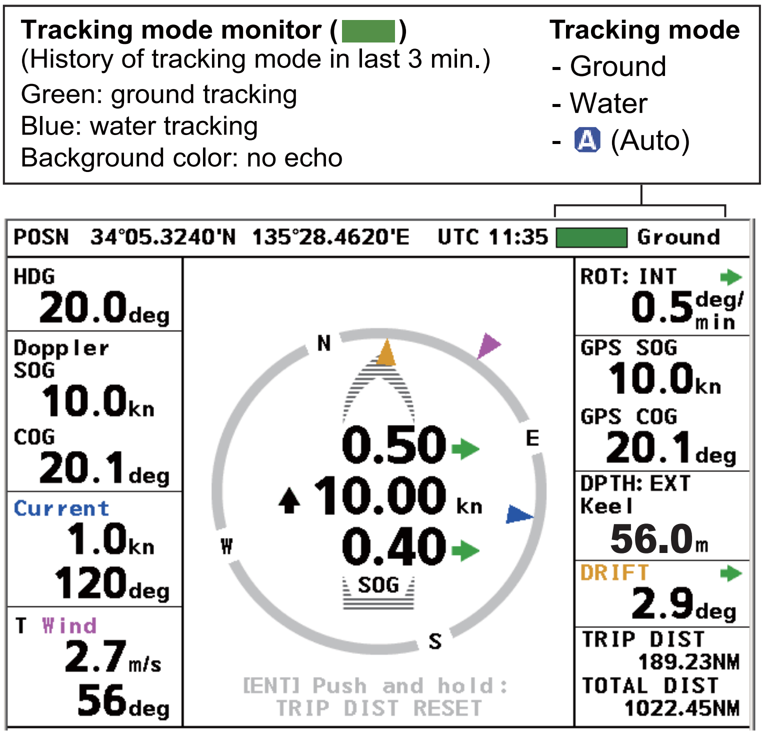
Trip distance, total distance run display

Default displays

1.5 How to Select a Tracking Mode

Press the **TRKG MODE** key (main display unit) or the **MODE** key (Remote Controller) to select a tracking mode, among ground, water and auto. Select the mode according to the depth and speed. The tracking mode indication, Ground, Water, or A (Auto), appears at the top-right corner.

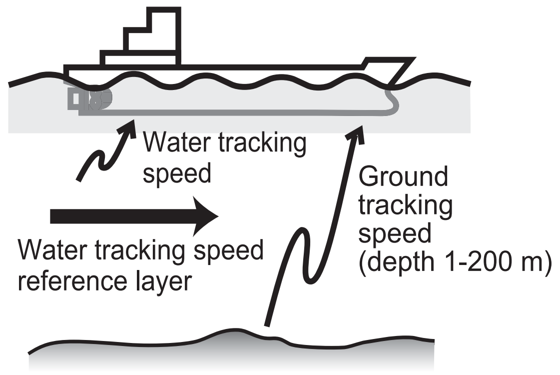
The tracking mode monitor (bar) at the top of the display shows the history of tracking modes for the past three minutes. The bar is updated every three seconds and scrolls leftward. The color of the bar is green for ground tracking, blue for water tracking, and background color when there is no echo input.



Description of tracking modes

Ground: Measure and display a speed relative to the sea bottom. The depth from the keel must be 1-200 m to use this mode.

Water: Measure and display a speed relative to the watermass. The depth from the keel must be at least three meters to use this mode. However, the accuracy is lower when the clearance is less than 40 m.
The reference layer can be set with [Track Depth] on the [System menu]. See section 5.7.



In the ground tracking mode, the bottom is used as reference to calculate movement.

Auto: Automatically selects ground tracking mode or water tracking mode according to the depth. The water tracking mode is selected when the keel clearance is 200 m or more. (Actual working depth in the ground tracking mode depends on the bottom and water conditions, and the reflection properties for sonic pulses.)

1.6 How to Change Units of Measurement

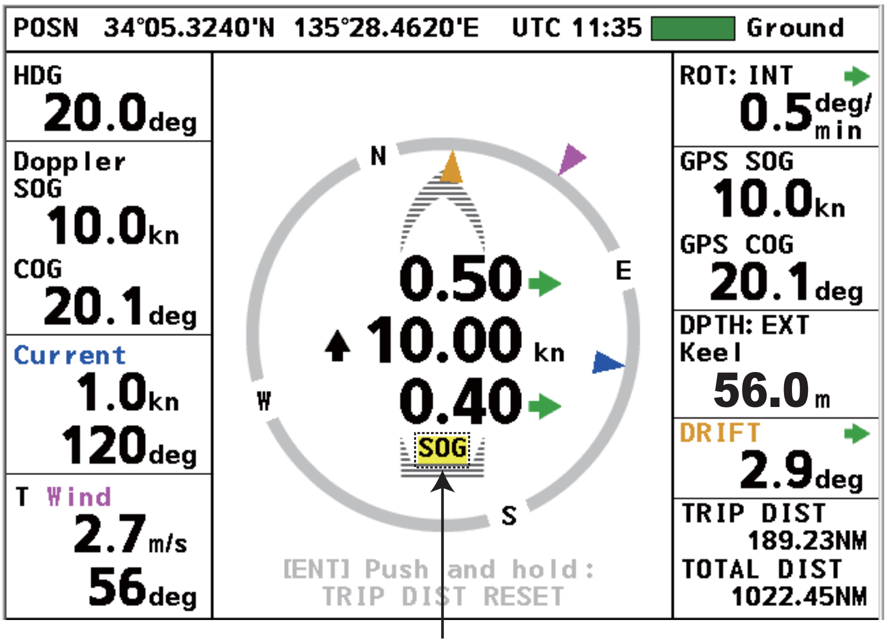
The **UNIT** key selects the unit of measurement for current (tide) speed, depth, distance, Doppler SOG and STW, GPS SOG, and wind speed.

Single data display

Press the **UNIT** key to select a unit of measurement.

Multiple data display

1. Press the **UNIT** key. A unit is highlighted in yellow.
   In the example of the navigation data display shown below, the speed unit is highlighted.



Highlight (yellow)

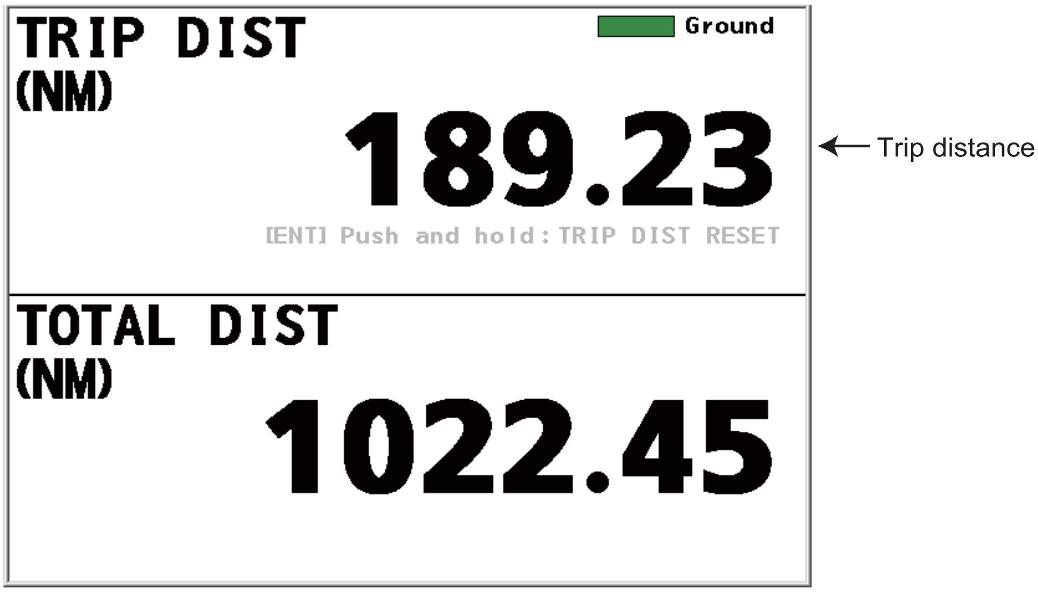
2. Press the **DISP** key to select the data for which to change its unit. (Use the **MENU/ESC** key to reverse the selection order.)
3. Press the **UNIT** key to change the unit. See the table below for item and available units.

Item	Available units
Berthing display range	meters/DIV (m/DIV), nautical miles/DIV (NM/DIV)
Current (tide) speed	knots (kn), meters/second (m/s)
Distance	kilometers (km), nautical miles (NM)
Depth	fathoms (fm), feet (ft), meters (m)
Ground tracking (SOG) Water tracking (STW)	kilometers/hour (km/h), knots (kn), meters/second (m/s)
Wind speed	knots (kn), meters/second (m/s), miles/hour (mph)

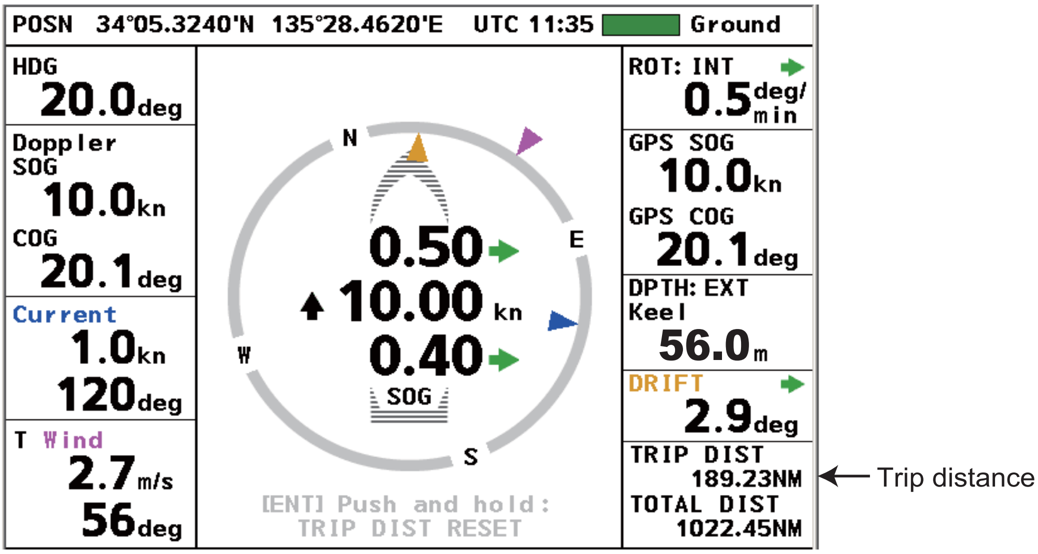
To quit the unit selection, press the **DISP** or **MENU/ESC** key until the yellow highlight disappears.

1.7 How to Reset the Trip Distance Indication

You can reset the trip distance indication on the displays that shows the trip distance. Press the **ENT** key until the trip distance indication shows all zeroes. (Trip distance can also be reset from the menu, with [Trip DIST]→ [RESET].)



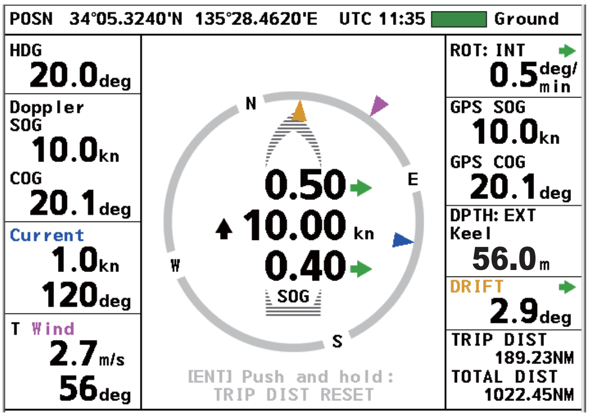
Trip distance, total distance display



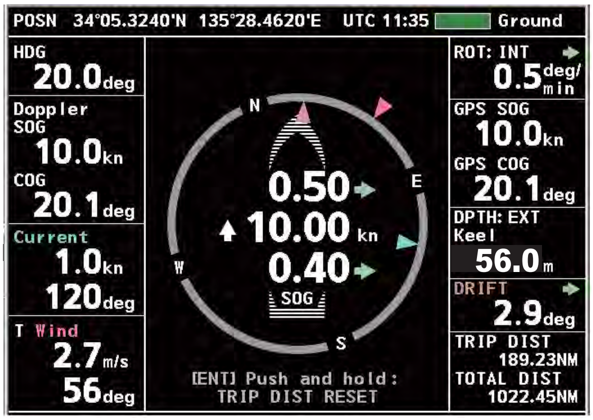
Navigation data display

1.8 How to Select Daytime and Nighttime Displays

The **DAY/NT** key selects the daytime (black characters on a white background) and nighttime (white characters on a black background) displays alternately, for comfortable viewing according to the time of day.



Daytime

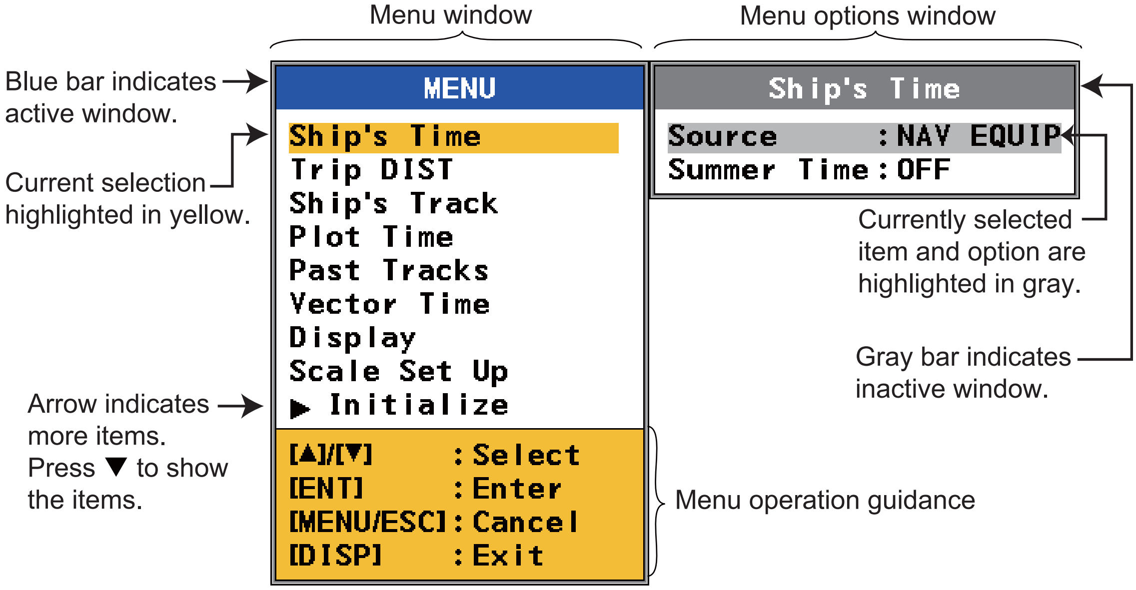


Nighttime

1.9 General Menu Operation

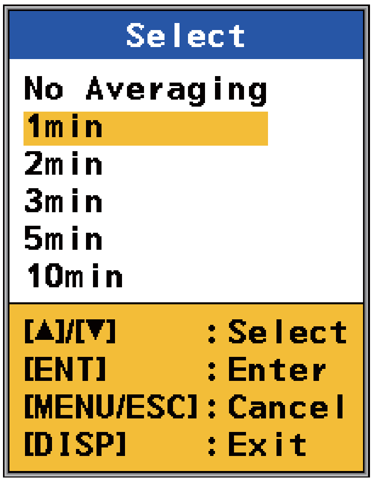
This section shows basic menu operation procedures.

1. Press the **MENU/ESC** key to open the menu. The menu window and the menu options window for the currently selected menu item appear.



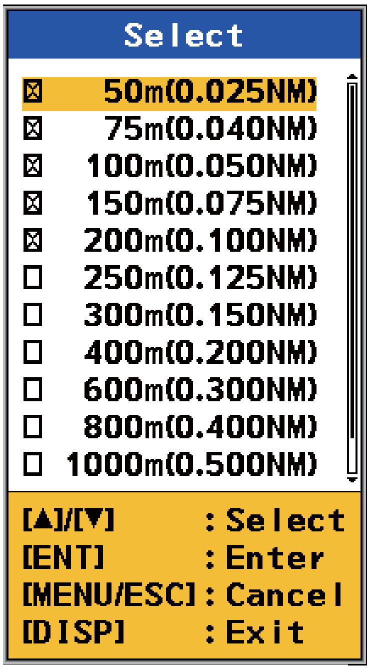
2. Press ▲, ▼ to select a menu item then press the **ENT** key. Control is then given to the menu options window.
   Note: Hereafter we write "Select [name of menu item] then press the **ENT** key." where you use ▲,▼ to select an item or option and the **ENT** key to confirm selection.

3. Select an item from the menu options window then press the **ENT** key. One of the four types of boxes shown below appears. Follow the related procedure to make your selection.



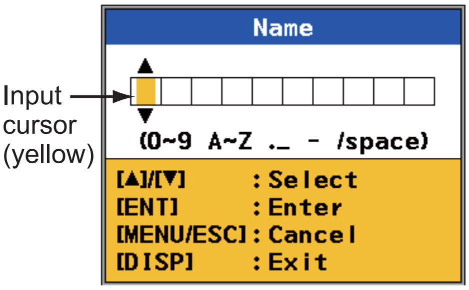
List box

1. Select option with ▲, ▼.
2. Press **ENT** key.



Check box

1. Select option with ▲, ▼.
2. Press **ENT** key to check or uncheck box.

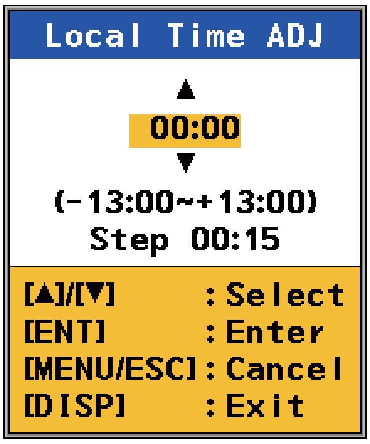


Spinner box(alphanumeric data)

The input cursor is initially at the far-left position.

1. Select character with ▲, ▼.
2. Press **ENT** key to confirm. The input cursor moves to next input point.
3. Repeat steps 1 and 2 to complete the name.

You can move the input cursor with **ENT**, **MENU/ESC**.
ENT: Move right.
MENU/ESC: Move left.



Spinner box(numeric data)

1. Set value with ▲, ▼.
2. Press **ENT** key to confirm.

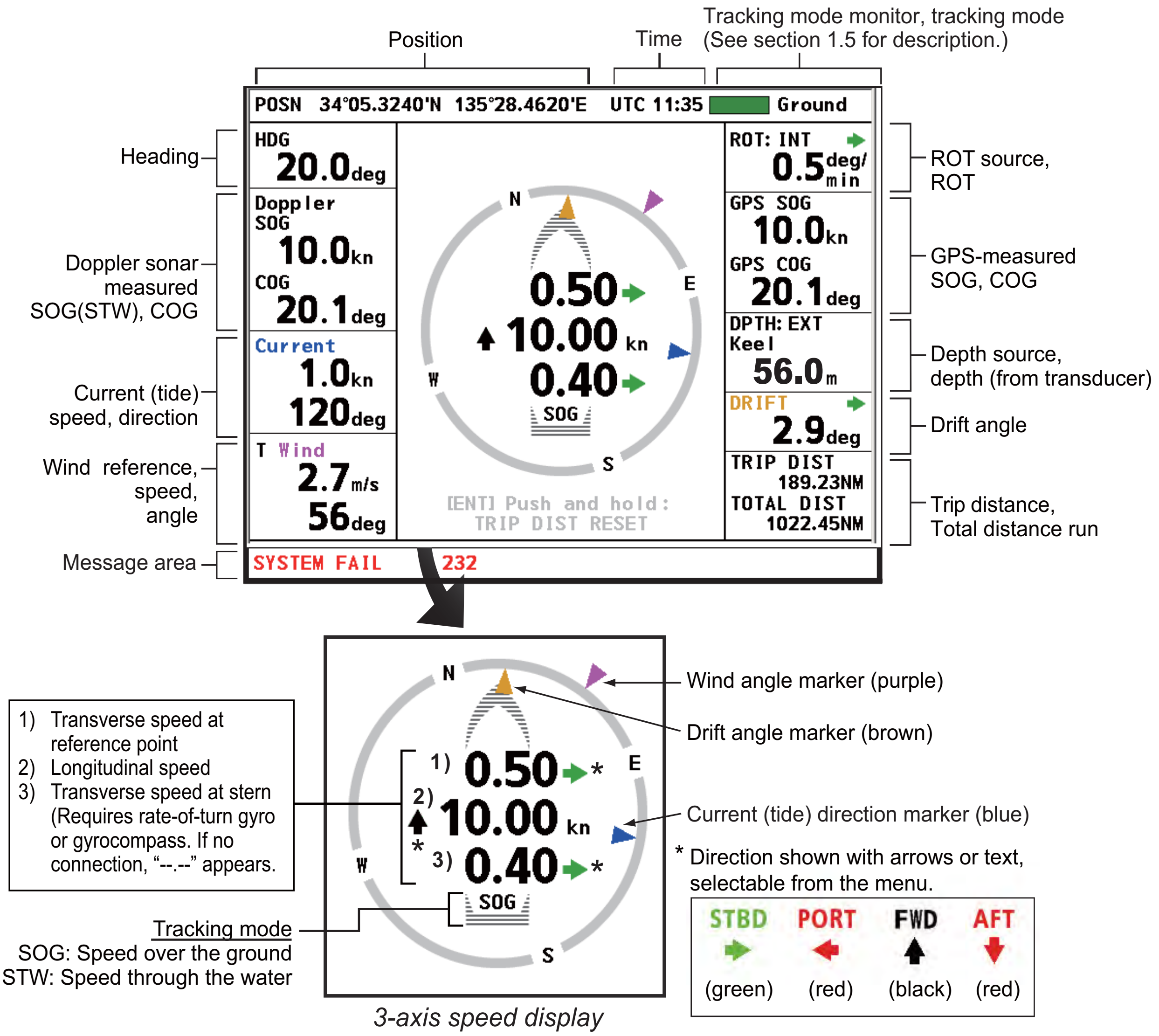
4. Control is returned to the menu window. Press the **DISP** key to close the menu.

2. NAVIGATION DATA DISPLAY

2.1 Navigation Data Display Overview

The navigation data display provides comprehensive navigation data (with connection of related sensors) and a 3-axis speed display. When a data is lost, its numerical indication is shown with hyphens; for example, “---.-”. When a data is in error, its unit; for example, “kn,” is shown in white characters on a red background. The “normal” unit appears again when the data returns.

The 3-axis speed display mainly shows transverse speed at the reference point, longitudinal speed and transverse speed at the stern. The direction indicators can be shown with arrows or text, selectable from the menu. Wind angle, drift angle and current (tide) direction are indicated with purple, brown and blue triangles, respectively.



3-axis speed display

2.1.1 Description of indications

Descriptions in clockwise order from top-left corner.

POSN Latitude and longitude position of your ship, input by a position-fixing equipment (GPS, etc.).

Time Time, input by a position-fixing equipment, is available in UTC or local time, selectable from the menu. The time format is shown before the time, "UTC" for Universal Coordinated Time, or "TIME" for local time. Daylight savings time can be activated and deactivated from the menu.

Tracking monitor Show the history of the tracking mode in the last three minutes. See section 1.5.

Tracking mode Show the current tracking mode: Ground, Water, or Auto. See section 1.5.

ROT Source of ROT (Rate of Turn) and ROT value. The source of ROT can be selected from the menu. See section 2.2.7.

GPS SOG GPS-measured speed over the ground. When the GPS signal is lost, “--.-” appears.

GPS COG GPS-measured course over the ground.When the GPS signal is lost, “---.-” appears.

DPTH Depth can be shown from the transducer or from the keel (fed from external source), selectable from the menu.
Note: The ultrasound beam is injected into water at an angle. The returning echo from a bottom arrives at an angle to the transducer and is converted into a downward-measured depth. The depth measured to a flat bottom meets the accuracy denoted in the specifications, however the depth to a sloping bottom is not the “true” depth.

DRIFT The drift angle. The drift angle is shown on the 3-axis speed display with a brown triangle.

TRIP DIST Trip distance indication.

TOTAL DIST Total distance run indication. You can reset and adjust the indication from the menu.

Wind Wind reference, speed and angle, input by a wind-measuring device. The wind angle is shown on the 3-axis speed display with a purple triangle. Wind reference (True, Theoretical or Relative) and wind averaging time can be set on the menu.

Current Current (tide) speed and direction. The direction of the current is shown in the 3-axis speed display with a blue triangle. This graphic can show the direction the current is flowing from, or the direction the current is flowing to. The blue triangle is inside the 3-axis speed display when the direction is “flowing to”, and outside that display when the direction is “flowing from”. You can set the indication method on the menu. See section 2.2.4.

Doppler SOG (or STW) Doppler sonar-measured speed over the ground or speed through the water.

Doppler COG Doppler sonar-measured course over the ground.

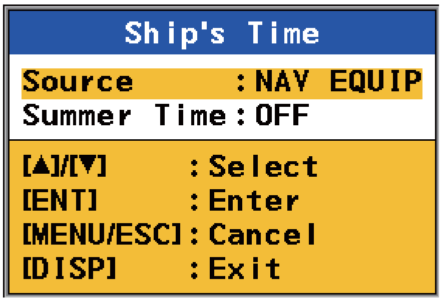
HDG Current heading, input by a gyrocompass. “0°” appears if there is no gyrocompass connected.

2.2 How to Set Navigation Data

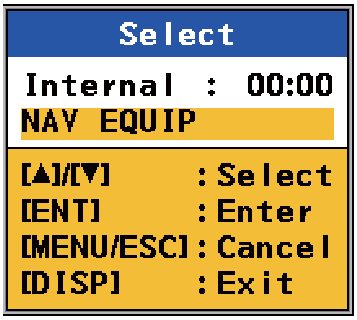
2.2.1 Time

This section shows you how to select the source for time, set local time, and turn summer time indication (daylight savings time) on or off.

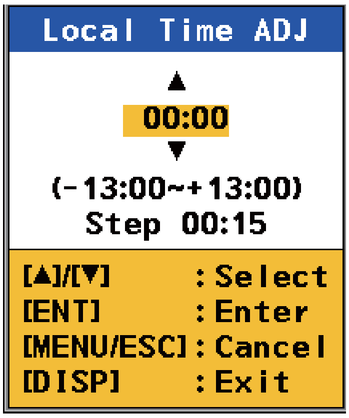
1. Press the **MENU/ESC** key to open the menu.
2. Select [Ship's Time] then press the **ENT** key.



3. Select [Source] then press the **ENT** key.

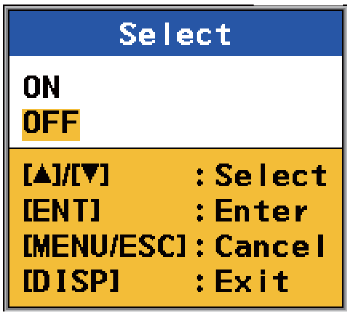


4. Select [Internal] or [NAV EQUIP] then press the **ENT** key. Select [Internal] to use local time, or [NAV EQUIP] to use UTC time. For [Internal], the [Local Time ADJ] screen appears; go to step 5. For [NAV EQUIP], go to step 6.



5. Use ▲, ▼ to set the time difference between local time and UTC time then press the **ENT** key.

6. Select [Summer Time] (to turn the daylight savings time indication on or off) then press the **ENT** key.

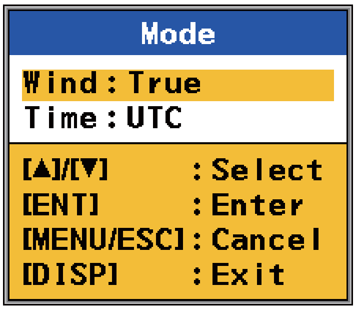


7. Select [ON] or [OFF] then press the **ENT** key.
8. Press the **DISP** key to close the menu.

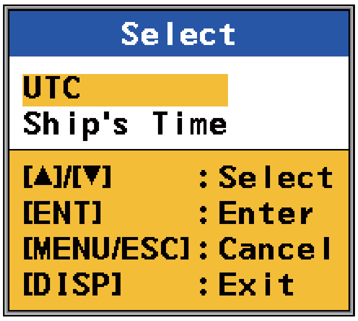
2.2.2 Time format

You can display time in UTC or ship’s time (local time).

1. Press the **MENU/ESC** key to open the menu.
2. Select [Scale Set Up] then press the **ENT** key.
3. Select [Mode] then press the **ENT** key.



4. Select [Time] then press the **ENT** key.

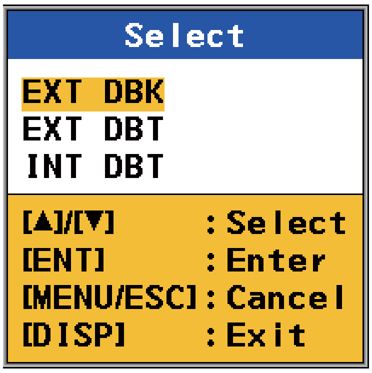


5. Select [UTC] or [Ship’s Time] then press the **ENT** key.
6. Press the **DISP** key to close the menu.

2.2.3 Depth measurement reference

The depth can be measured from below the keel (fed from external source), or below the transducer. The depth data can be supplied by the transducer of the DS-60 or an external transducer.

1. Press the **MENU/ESC** key to open the menu.
2. Select [Scale Set Up] then press the **ENT** key.
3. Select [Depth REF] then press the **ENT** key.

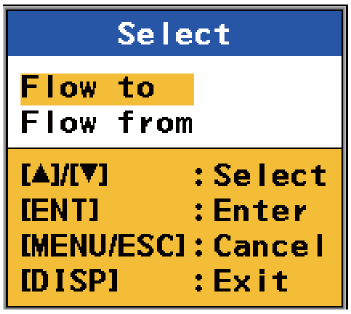


4. Select desired depth measurement reference then press the **ENT** key.
   [EXT DBK]: Depth Below the Keel, measured by external equipment
   [EXT DBT]: Depth Below the Transducer, measured by other transducer
   [INT DBT]: Depth Below the Transducer, measured by the transducer of the DS-60
5. Press the **DISP** key to close the menu.

2.2.4 Current direction

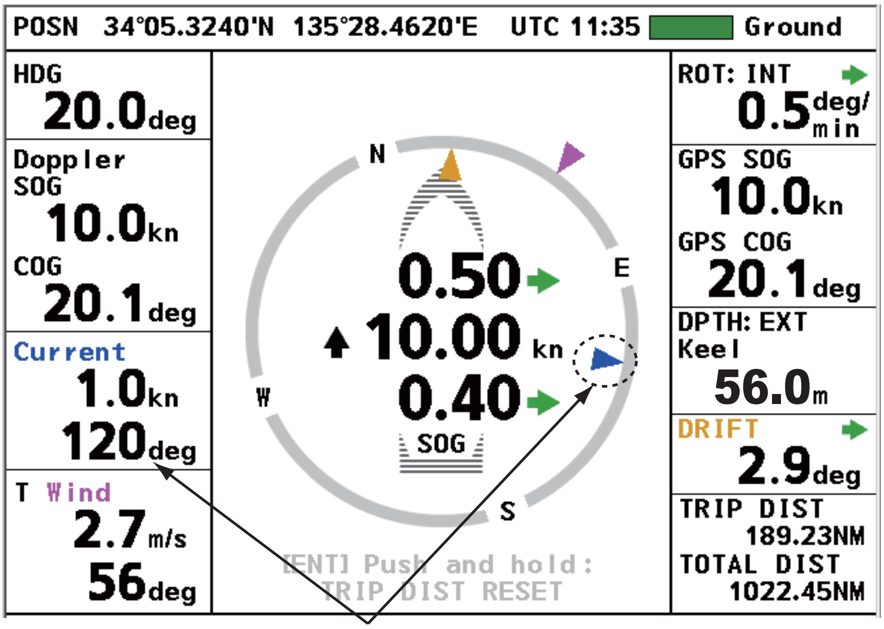
The direction of tide currents can be shown as flowing from or flowing to. The current direction indicator (blue triangle marker) is inside the 3-axis speed display for flowing to and outside the display for flowing from. (See the figure on the next page.)

1. Press the **MENU/ESC** key to open the menu.
2. Select [Scale Set Up] then press the **ENT** key.
3. Select [CUR Direction] then press the **ENT** key.

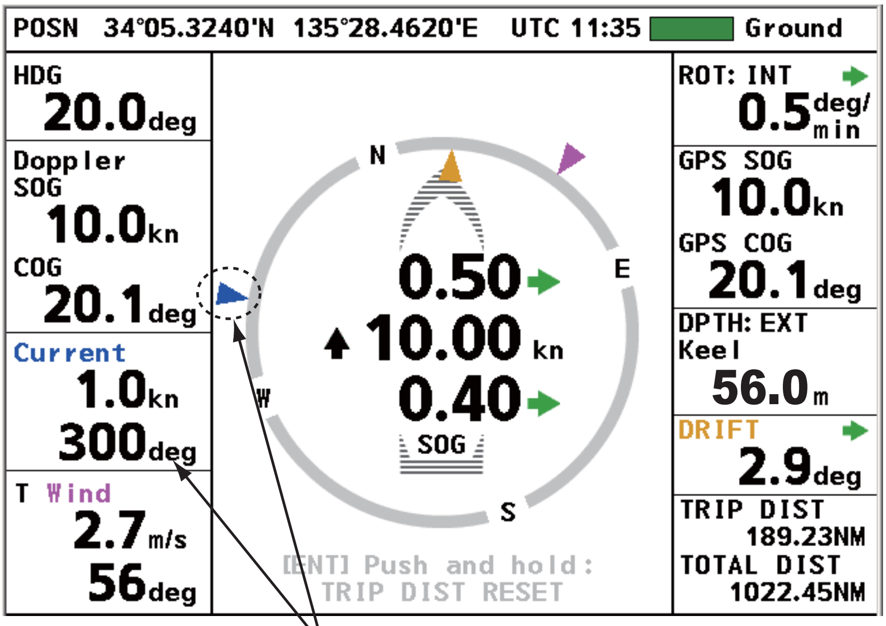


4. Select [Flow to] or [Flow from] then press the **ENT** key.

5. Press the **DISP** key to close the menu.



Flow to (example: 120°)

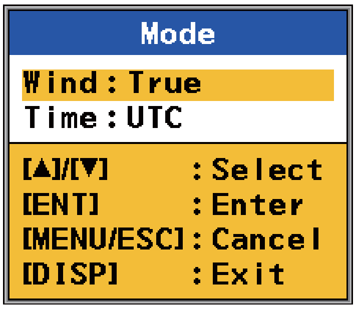


Flow from (example: 300°)

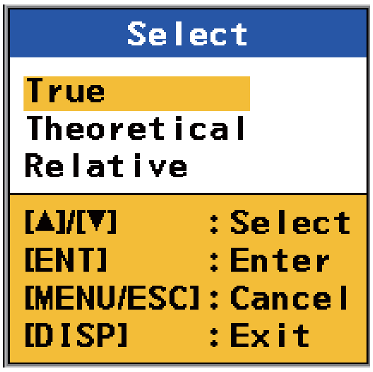
2.2.5 Wind angle

The wind angle can be shown as Relative, True or Theoretical.

1. Press the **MENU/ESC** key to open the menu.
2. Select [Scale Set Up] then press the **ENT** key.
3. Select [Mode] then press the **ENT** key.



4. Select [Wind] then press the **ENT** key.

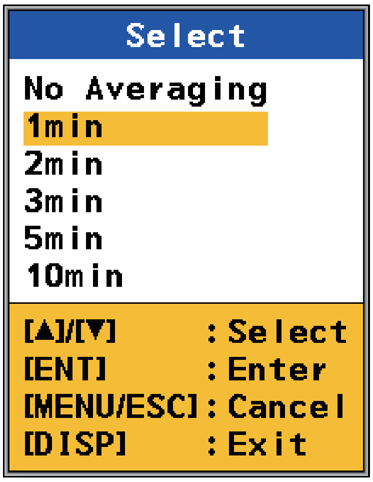


5. Select [True], [Theoretical] or [Relative] then press the **ENT** key.
   [True]: The wind speed and angle minus movement of ship, reference to North.
   [Theoretical]: The wind speed and angle minus movement of ship, reference to ship's bow.
   [Relative]: The speed and relative direction that the wind appears to blow with ship in motion, reference to ship's bow.
6. Press the **DISP** key to close the menu.

2.2.6 Wind averaging time

Set the wind averaging time in minutes. Select [No Averaging] for no averaging. The higher the time, the smoother the wind data, but response to the changes in wind speed and angle slows.

1. Press the **MENU/ESC** key to open the menu.
2. Select [Wind Average] then press the **ENT** key.

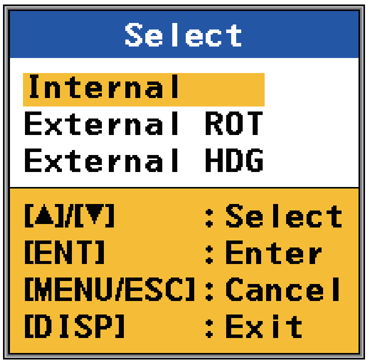


3. Select a value then press the **ENT** key.
4. Press the **DISP** key to close the menu.

2.2.7 ROT sensor

Select the ROT sensor as follows:

1. Press the **MENU/ESC** key to open the menu.
2. Select [ROT Sensor] then press the **ENT** key.

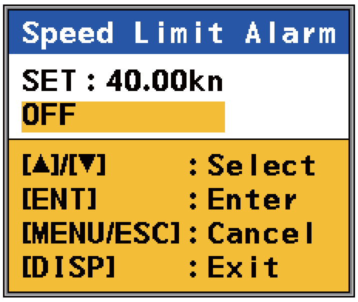


3. Select a source then press the **ENT** key.
   [Internal]: Select this item if the optional Rate-Of-Turn-Gyro is connected.
   [External ROT]: Receive ROT data from external ROT sensor.
   [External HDG]: Receive ROT data from gyrocompass or heading sensor.
4. Press the **DISP** key to close the menu.

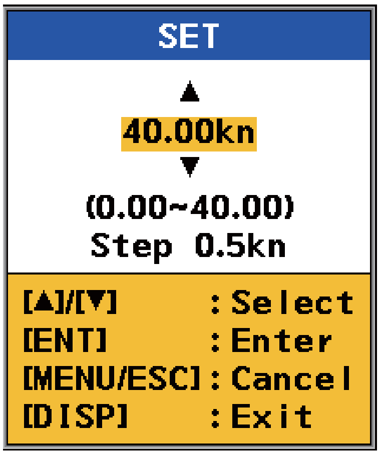
2.3 How to Set the Speed Alarm

The speed alarm sets the maximum allowable speed. If the speed of the ship goes higher than the speed set here, the audible alarm sounds and the message "Speed Alarm 300" appears. You can stop the audible alarm with the **ALARM ACK** key. The message remains on the screen until you deactivate the alarm.

1. Press the **MENU/ESC** key to open the menu.
2. Select [Speed Limit Alarm] then press the **ENT** key.



3. Select [SET] then press the **ENT** key.



4. Press ▲ or ▼ to set the maximum allowable speed then press the **ENT** key. The setting range is 0.05 to 40 kn, in 0.5 kn increments.
5. Press the **DISP** key to close the menu.

To deactivate the alarm, select [OFF] at step 3 then press the **DISP** key.

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3. BERTHING DISPLAY

3.1 Berthing Display Overview

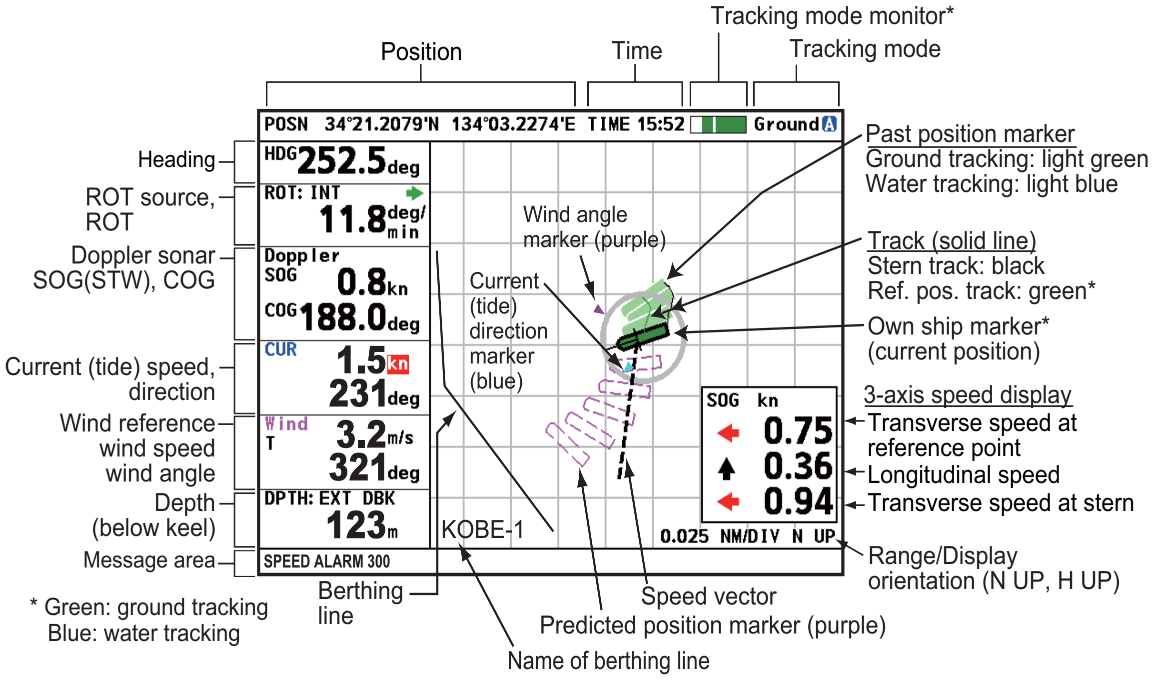
The berthing display shows ship's track (past and/or predicted) and provides help with berthing operations. With position and heading inputs, customizable berthing lines can be shown to help in berthing.

The display orientation is available in Head-up and North-up. Head-up has your heading at the screen top and North-up has North at the top.

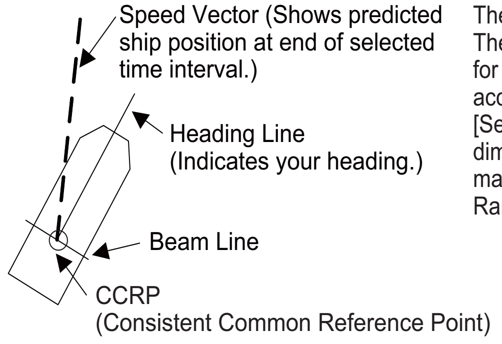
The navigation data, which appears at the left side of the display, can be shown or hidden as necessary.

Current (tide) direction and wind angle markers, shown with blue and purple triangle markers respectively, provide quick identification of respective direction or angle.

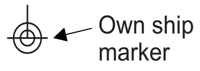
The 3-axis speed display shows ship's speed in three axes: transverse speed at the reference point, longitudinal speed, and transverse speed at the stern. The display is positioned at the bottom-right corner or top-left corner depending on the location of the own ship marker. You can show or hide the display as required.



Own ship marker



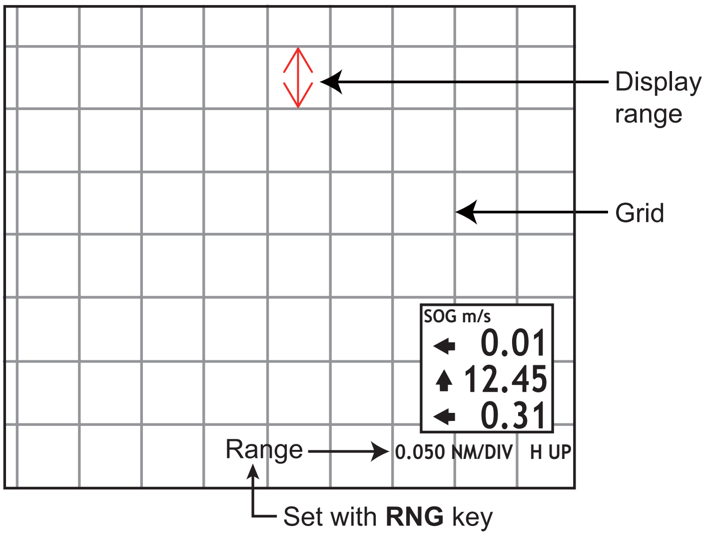
The own ship marker indicates current position. The marker is green for ground tracking and blue for water tracking. The marker is scaled according to ship length and width, set on the [Setting Ship Data] menu. If the range and dimensions of the ship are as shown below, the marker is shown with concentric circles.
Range x 8 ≥ Ships length x 30, or Width x 52



3.2 Display Range

3.2.1 How to select a range

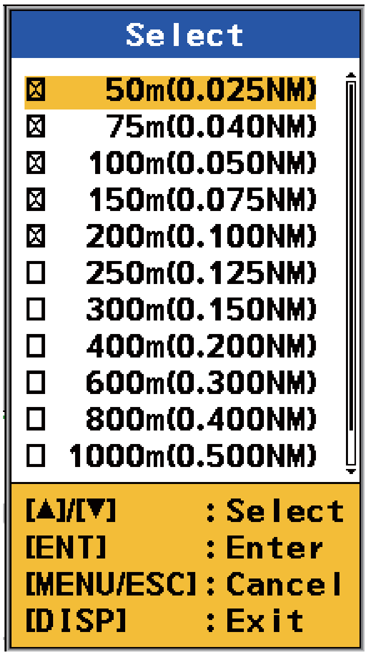
The display range is the distance between grid sides on the berthing display. Use the **RNG** key to select a range. The range appears below the 3-axis speed display as shown below. The system is pre-set with five ranges (nm): 0.025, 0.04, 0.05, 0.075 and 0.1. A total of 11 ranges are available and you can select the ranges to use from the menu, as shown in the next section.



3.2.2 How to pre-set ranges

The berthing display has a total of 11 ranges. Select the ranges to use, following the procedure shown below. A minimum of one range must be turned on.

1. Press the **MENU/ESC** key to open the menu.
2. Select [Set Up Scale] then press the **ENT** key.
3. Select [Range] then press the **ENT** key.
4. Select a range then press the **ENT** key. Show "X" in a check box to select the range, or remove the "X" to deselect the range.
5. Press ▼ to show and select [Save] then press the **ENT** key.
   Note: If all ranges are turned off, the message "No item be selected" appears. Select at least one range.
6. Press the **DISP** key to close the menu.



3.3 Track

The DS-60 uses speed data to plot your ship's track on the display. You can show past track or predicted track, or both past and predicted tracks.

3.3.1 Types of tracks

Two types of track are available: past and predicted.

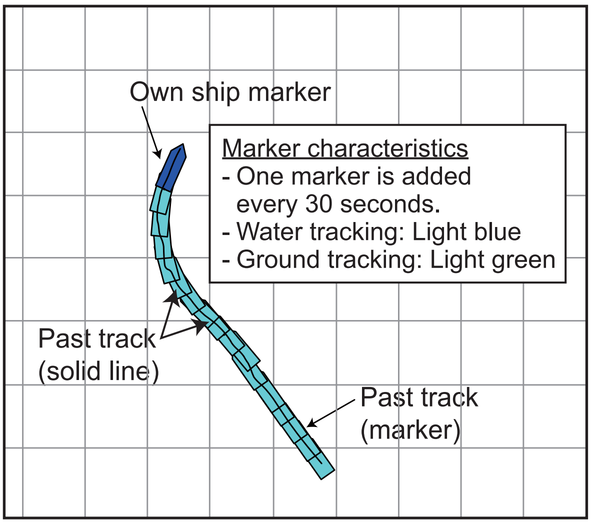
Past track

Past track can be shown with past ship markers or both solid lines and past ship markers.

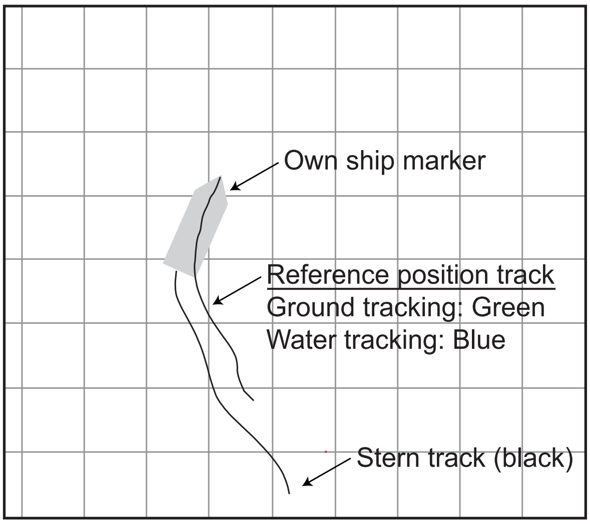
There are two types of past track: reference position track and stern track. The reference position track is green (ground tracking) or blue (water tracking), and the stern track is black. The tracks of the past five minutes are shown. .

A past track marker is added every 30 seconds. The markers are colored light blue for water tracking, and light green for ground tracking. The last five minutes of past track markers are shown

You can select the type of past track to show from the menu. See section 3.3.3 for the procedure.



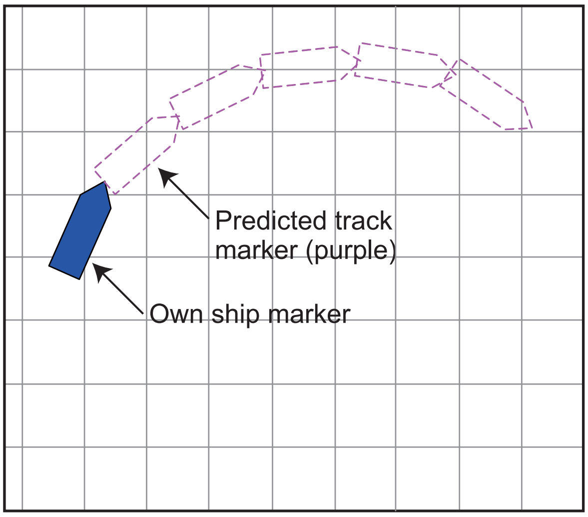
Past track (marker and solid line)



Past track (solid line)

Predicted track

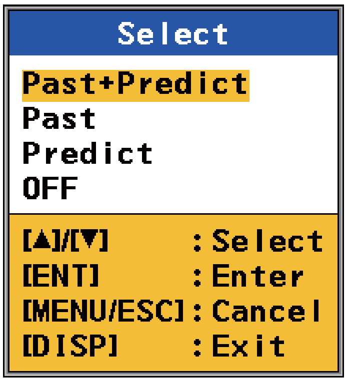
The predicted track feature shows estimated position of your ship at the end of the selected time interval. (See section 3.3.4 for the procedure.) The estimated position is calculated from the reference point and stern speeds taken from the ground and water tracking speed data. The marker is purple, hollow and dashed to distinguish it from the own ship marker and the past track markers.



Predicted track

3.3.2 How to select the type of track to display

1. Press the **MENU/ESC** key to open the menu.
2. Select [Ship's Track] then press the **ENT** key.

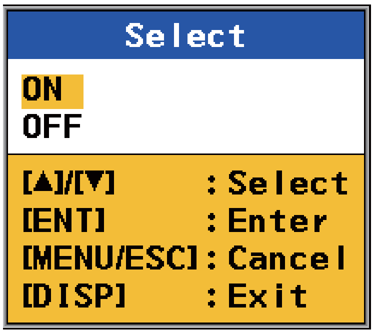


3. Select the type of track to display then press the **ENT** key. Select [OFF] to hide all tracks.
4. Press the **DISP** key to close the menu.

3.3.3 How to select the past track format

The past track can be shown with a solid line or solid line and past track markers. See the illustration on page 3-3.

1. Press the **MENU/ESC** key to open the menu.
2. Select [Past Tracks] then press the **ENT** key.

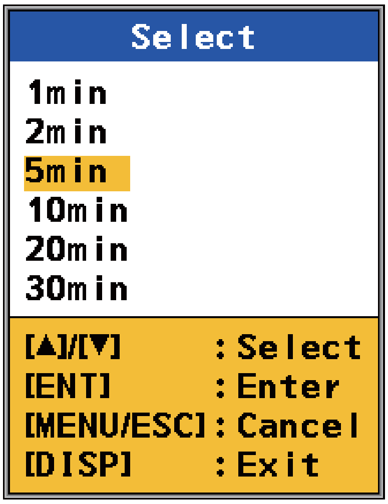


3. Select [ON] or [OFF] then press the **ENT** key.
   [ON]: Past track marker + solid line
   [OFF]: Past track marker only
4. Press the **DISP** key to close the menu.

3.3.4 How to select the predicted track plot interval

Select the interval at which to plot the predicted track as follows:

1. Press the **MENU/ESC** key to open the menu.
2. Select [Plot Time] then press the **ENT** key.

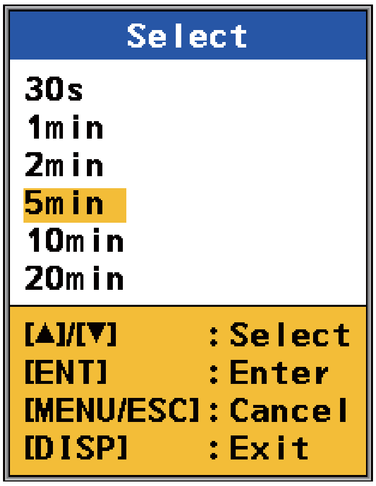


3. Select a time then press the **ENT** key. A new marker is plotted at equally time-spaced intervals of 1/5 of the plot time selected. For example, if you select the 10-minute interval, the predicted position is plotted at two-minute intervals.
4. Press the **DISP** key to close the menu.

3.4 How to Select Vector Time

The tip of the vector line on the own ship marker shows the estimated position of your ship after the selected vector time elapses, using the current course and speed. You can adjust the length of the vector line to see estimated position at the end of the prescribed time interval.

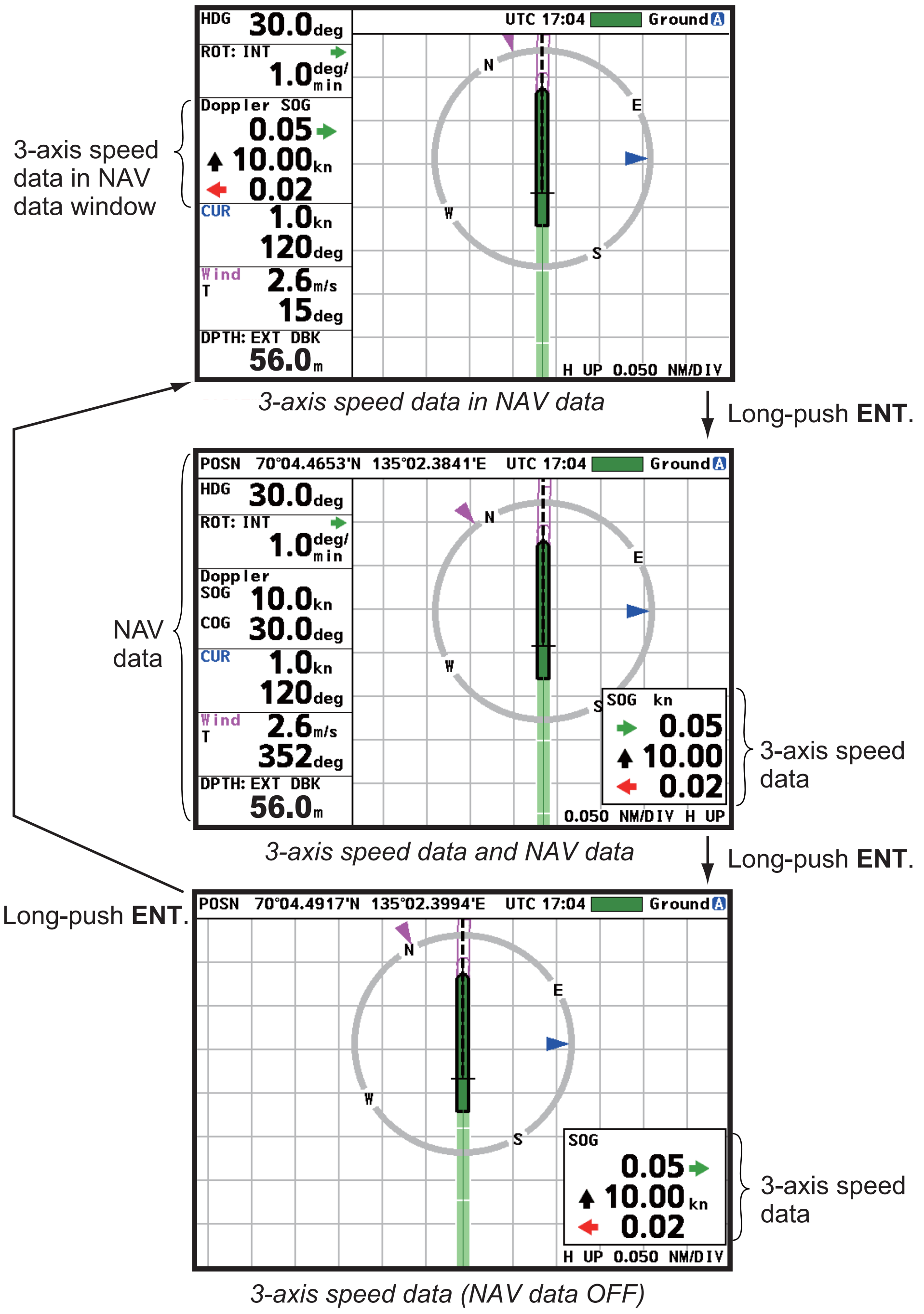
1. Press the **MENU/ESC** key to open the menu.
2. Select [Vector Time] then press the **ENT** key.



3. Select a vector time then press the **ENT** key. The longer the time, the longer the vector line.
4. Press the **DISP** key to close the menu.

3.5 How to Show, Hide Navigation Data and 3-axis Speed Data

The berthing display can show NAV data and 3-axis speed data. You can show them in separate windows, show the 3-axis speed data in the NAV data window, or show only the 3-axis speed data (no NAV data). Long-push the **ENT** key to show or hide the data, in the sequence shown below. The data can also be shown or hidden with [Data Display] in the [Scale Set Up] menu.



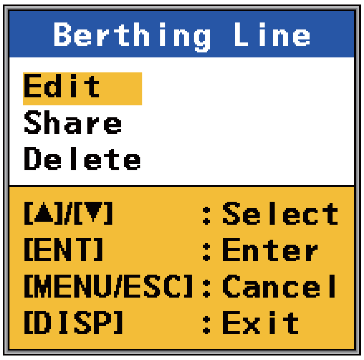
3.6 Berthing Line

A berthing line that represents an intended berth can be shown to help in berthing operations. The DS-60 stores a maximum of 100 berthing lines, and a berthing line can have a maximum of three points. All berthing lines within the current display range are automatically shown. A berthing line is automatically sent to all powered sub display units the moment the line is saved.

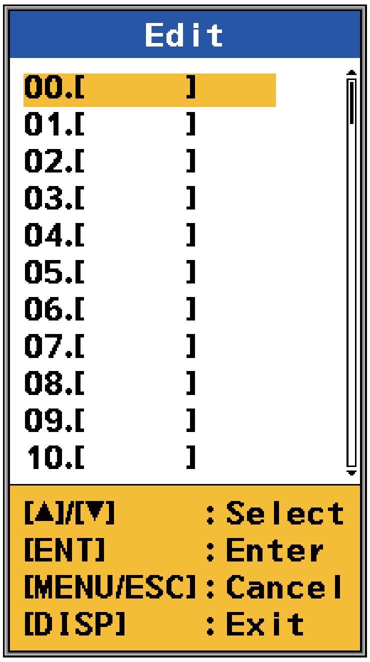
3.6.1 How to create a berthing line

Berthing lines can only be created from the main display unit.

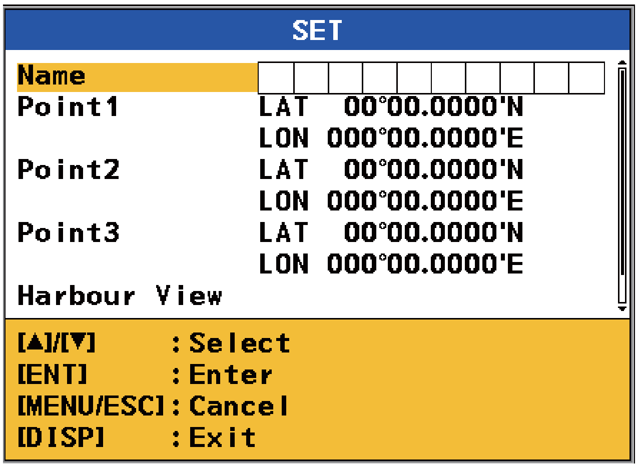
1. Press the **MENU/ESC** key to open the menu.
2. Select [Berthing Line] then press the **ENT** key.



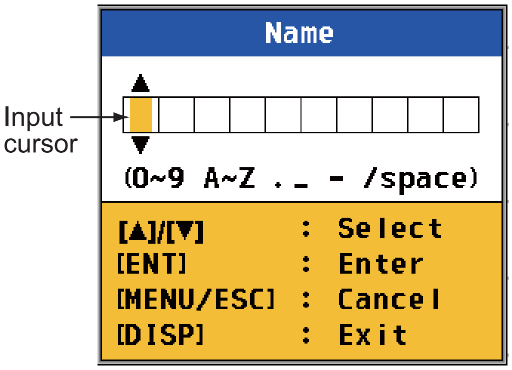
3. Select [Edit] then press the **ENT** key.



4. Select an empty number then press the **ENT** key.



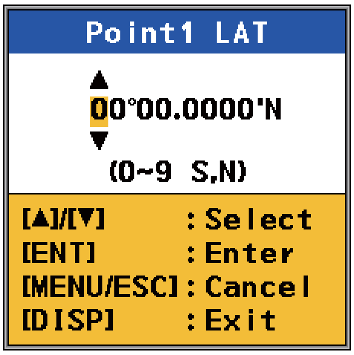
5. [Name] is selected; press the **ENT** key.



6. Enter a name for the berthing line. For example, the name of the harbor related to the berthing line.
   1) The input cursor is at the far-left position. Press ▲ or ▼ to select a character then press the **ENT** key. The input cursor moves to the next input point.
   2) Repeat step 1) to complete the name. To move the input cursor, use the **ENT** key to move it right, the **MENU/ESC** key to move it left.

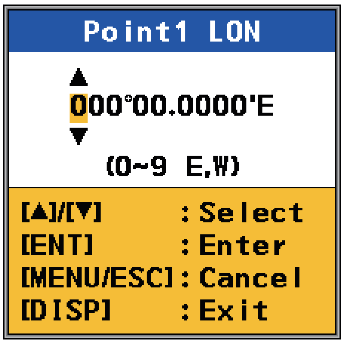
   Note: If you do not enter a name, the message "Please enter name." appears. Enter a name.

7. Press the **ENT** key to go to the [SET] menu.
8. Press ▼ to select the [LAT] line of [Point1] then press the **ENT** key.



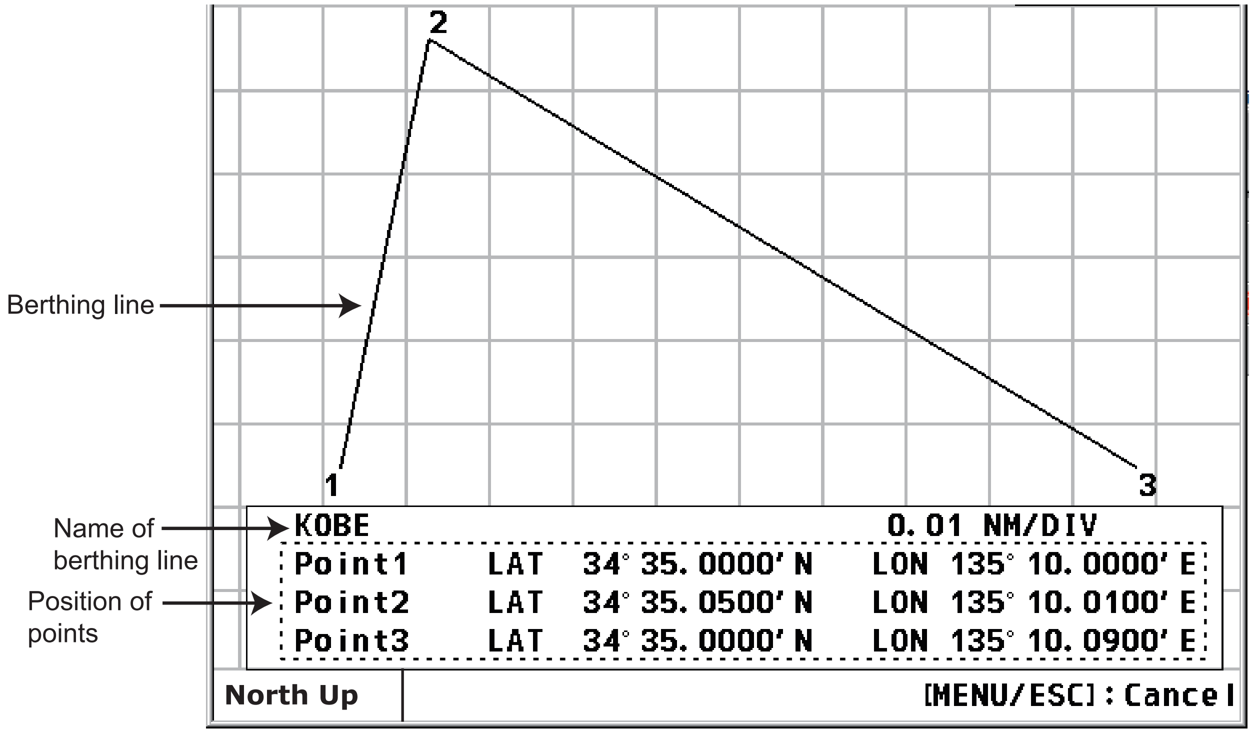
9. Use ▲ or ▼ to select the first digit of the latitude position then press the **ENT** key. Enter the remaining digits in the same method. (Use the **ENT** key to move the cursor right, and the **MENU/ESC** key to move the cursor left.)

10. Select the [LON] line of [Point1] then press the **ENT** key.

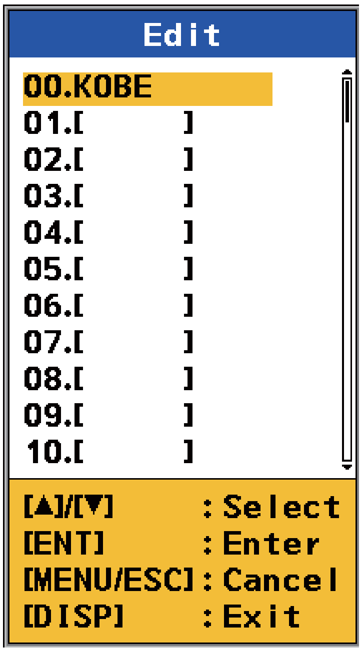


11. Enter the longitude, same as how you entered the latitude.
12. Enter the points 2 and 3.
13. Select [Harbour View] then press the **ENT** key. The display shows
    - Berthing line
    - Name of berthing line, and
    - Latitude and longitude position of each point.

    Note: If the distance between two consecutive points is more than one degree, the message “Points too far, maximum distance between points is 1 degree” appears. Reenter point(s).



14. To save the line, press the **MENU/ESC** key to return to the [SET] dialog box (see the figure at the top of page 3-9). Press ▼ to show and select [Exit] then press the **ENT** key. (The berthing line is sent to all active sub display units when the **ENT** key is pressed.)



Note: If you select [Harbour View] without entering a name, the message "Harbour Name/Berthing Line plans must be named individually, please enter name." appears. Enter a name.

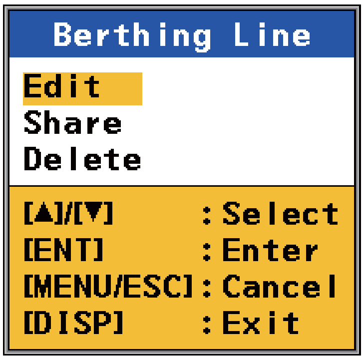
15. To make another berthing line, repeat steps 4-14. To finish, press the **DISP** key.

Note: You can edit berthing lines. Open the [Berthing Line] menu, select [Edit] then select a berthing line. The remaining procedure is similar to how you enter a berthing line.

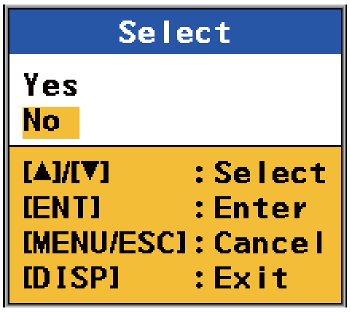
3.6.2 How to share berthing lines with sub display units

Berthing lines created at the main display unit are automatically sent to all sub display units that are active when the line is created. To send the berthing lines after a sub display unit becomes active, do as follows:

1. Press the **MENU/ESC** key to open the menu.
2. Select [Berthing Line] then press the **ENT** key.



3. Select [Share] then press the **ENT** key.

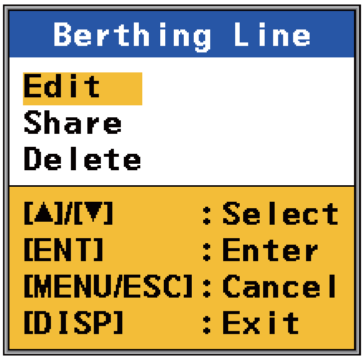


4. Select [Yes] then press the **ENT** key. All berthing lines in the sub display units are replaced with the berthing lines from the main display unit.
5. Press the **DISP** key to close the menu.

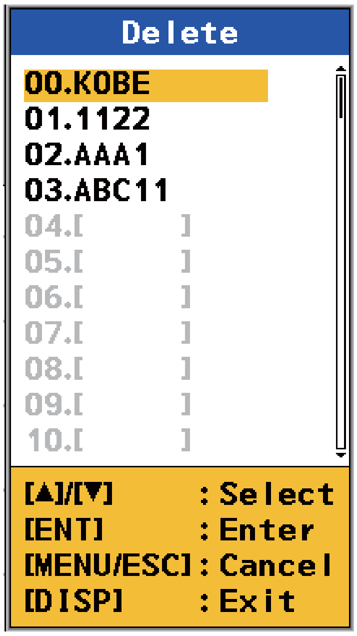
3.6.3 How to delete a berthing line

If you do not need a berthing line that you have made, you can delete the line as shown below. The line is deleted from both the main and sub display units.

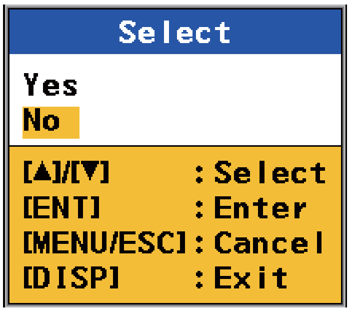
1. Press the **MENU/ESC** key to open the menu.
2. Select [Berthing Line] then press the **ENT** key.



3. Select [Delete] then press the **ENT** key to show the list of berthing lines.



4. Select the line to delete then press the **ENT** key. You are asked if you are sure to delete the line.



5. Select [Yes] then press the **ENT** key.
6. Press the **DISP** key to close the menu.

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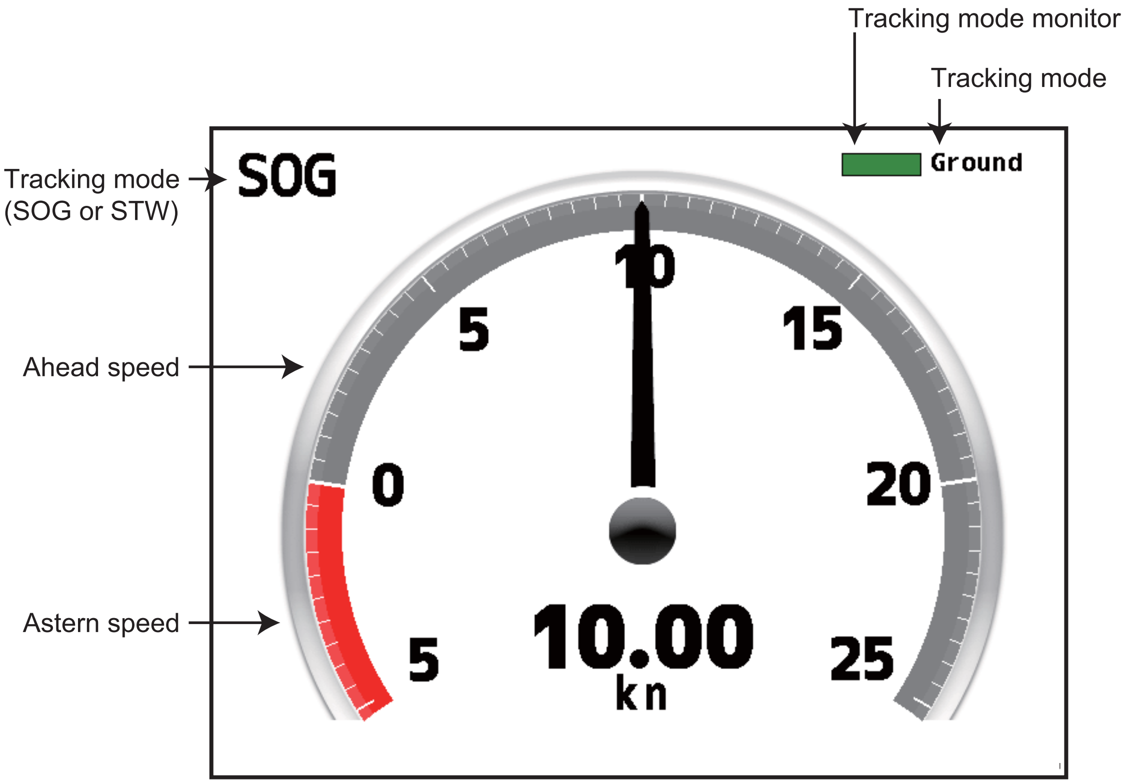
4. SPEED GRAPHIC DISPLAY

The speed graphic display, available with the sub display unit, provides absolute speed or ahead and astern speeds, in a speedometer arrangement.

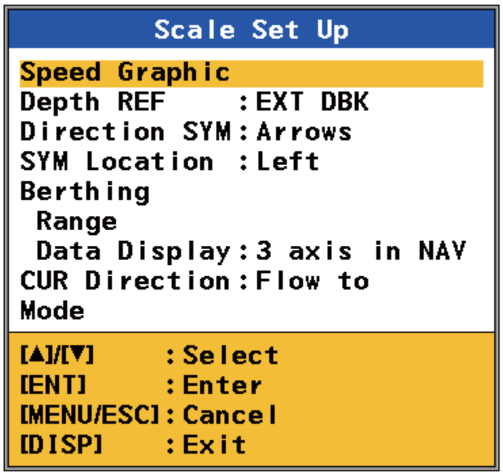
4.1 Speed Graphic Indications



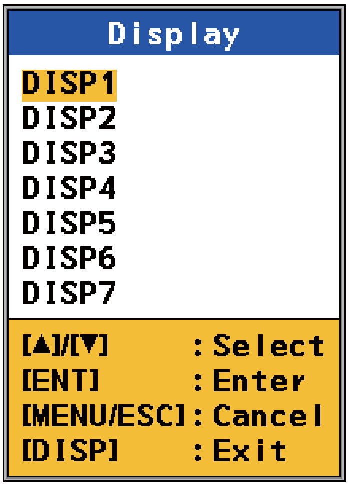
4.2 How to Activate the Speed Graphic

Select the display number where to show the speed graphic and the scale for the astern speed and ahead speed indications. The total display range for the two indications is 70 knots, and you can divide that total as required.

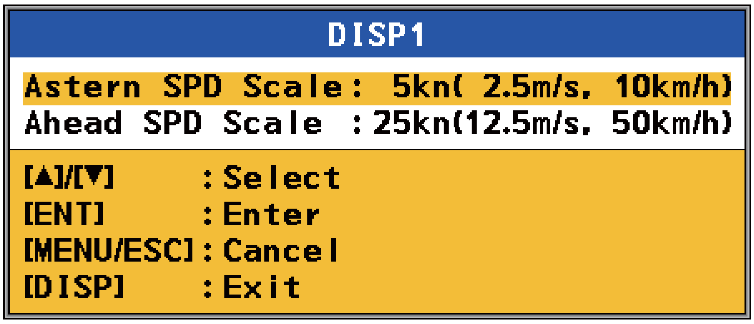
1. Press the **MENU/ESC** key to open the menu.
2. Select [Scale Set Up] then press the **ENT** key.



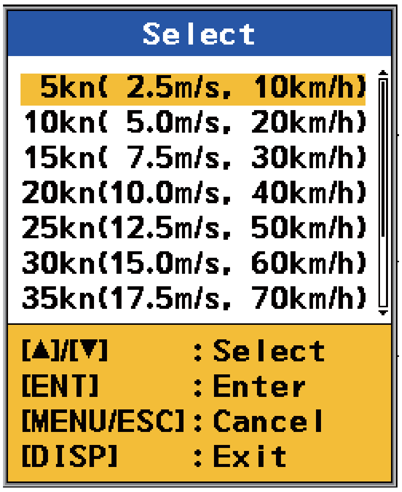
3. Select [Speed Graphic] then press the **ENT** key.



4. Select the display number (default display number for the graphic display is DISP5) where to show the speed graphic display then press the **ENT** key.



5. The cursor is selecting [Astern SPD Scale]; press the **ENT** key.

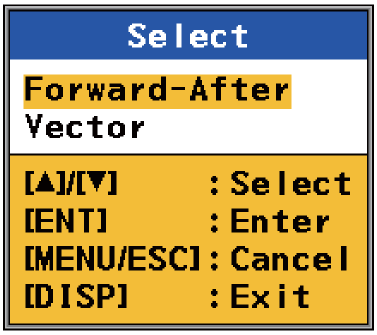


6. Select the scale range for the astern speed then press the **ENT** key.
7. Select [Ahead SPD Scale] then press the **ENT** key.
8. Select the scale range for the ahead speed then press the **ENT** key.
9. Press the **DISP** key to close the menu.

4.3 How to Select the Display Format for the Speed Graphic

The speed graphic can show absolute speed or ahead and astern speeds. Absolute speed is shown in three digits and ahead and astern speeds in four digits.

1. Press the **MENU/ESC** key to open the menu.
2. Select [Speed Select] then press the **ENT** key.



3. Select [Forward-After] or [Vector] then press the **ENT** key. See the illustration below.

"Forward-After" setting
(Four-digit speed indication)

When Direction SYM is set to "Text", "FWD" or "AFT" is shown. FWD or AFT not shown when "Arrows" is selected.

"Vector" setting
(Three-digit speed indication)
No text or arrows shown.

Speedometer display

"Forward-After" setting
(Four-digit speed indication)

When Direction SYM is set to "Text", "FWD" or "AFT" is shown. Arrows shown when "Arrows" is selected.

"Vector" setting
(Three-digit speed indication)
No text or arrows shown.

1-axis speed display

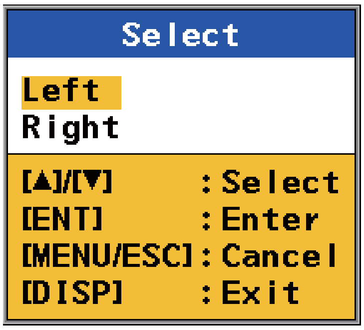
4. Press the **DISP** key to close menu.

4.4 How to Change the Speed Graphic Format

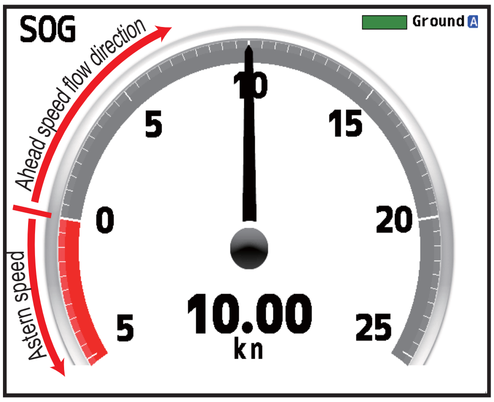
The default speed graphic has the zero point for the ahead and astern speedometers on the left side of the display, and the pointer moves rightward with increase in ahead speed. If desired, you can reverse that arrangement.

This setting also changes the position of the direction indicators on the digital speed displays. See section 5.5.

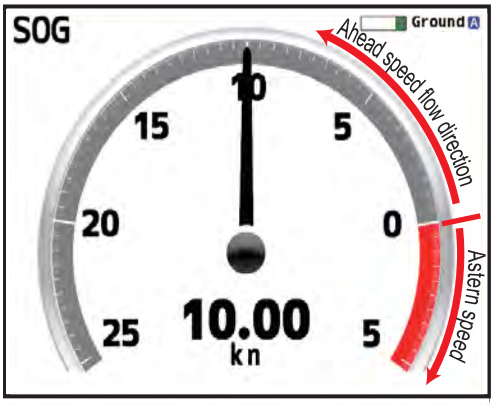
1. Press the **MENU/ESC** key to open the menu.
2. Select [Scale Set Up] then press the **ENT** key.
3. Select [SYM Location] then press the **ENT** key.



4. Select [Left] or [Right] then press the **ENT** key.
   [Left]: The pointer moves rightward with increase in ahead speed, and the zero point for the speedometers is on the left.
   [Right]: The pointer moves leftward with increase in ahead speed, and the zero point for the speedometers is on the right.



SYM Location "Left"



SYM Location "Right"

5. Press the **DISP** key to close the menu.

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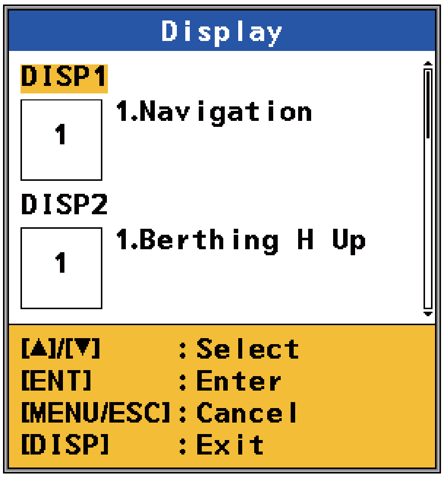
5. OTHER OPERATIONS

This chapter provides the descriptions for the menu items not described in other chapters.

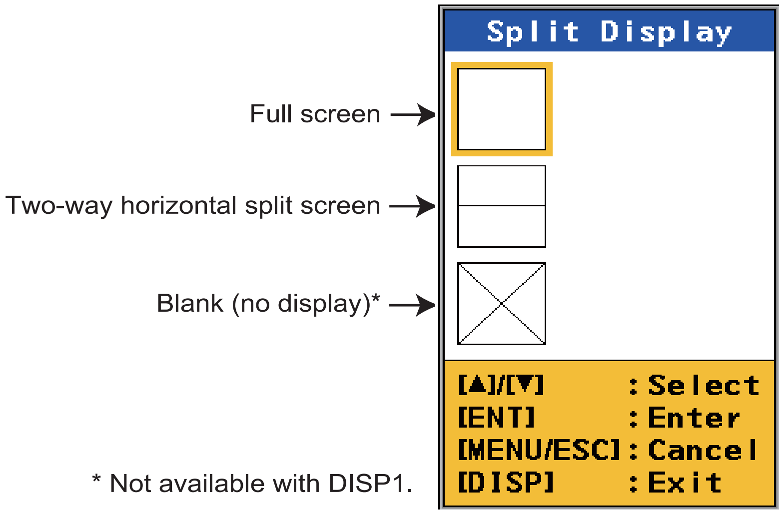
5.1 How to Set the Displays

The DS-60 is pre-set with four displays and you can set a maximum of seven displays. There are two types of screen arrangements: full screen and two-way horizontal split screen. A full-screen display can show a graphic display (navigation data, berthing, speed graphic (sub display unit only)), or digital data (trip distance, heading, etc.). A two-way horizontal split screen can show two digital data.

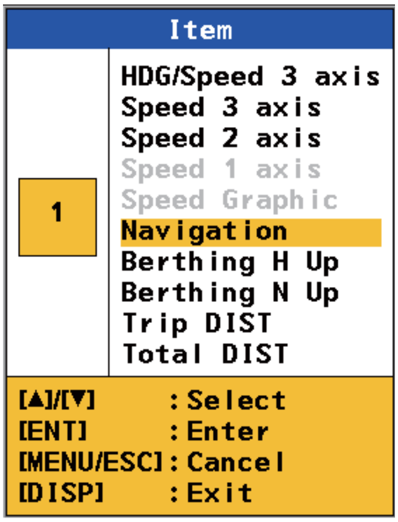
1. Press the **MENU/ESC** key to open the menu.
2. Select [Display] then press the **ENT** key.



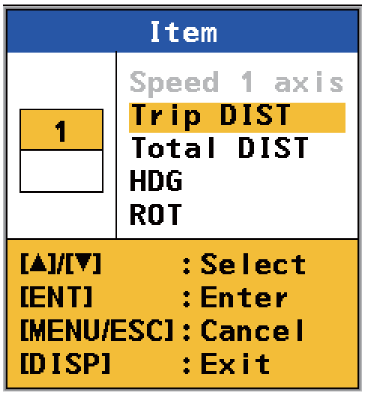
3. Select a display number ([DISP1] - [DISP7]) then press the **ENT** key.



4. Select the full screen, two-way horizontal split or blank icon (no display) then press the **ENT** key. The display now shows the selections available for the type of screen you selected.



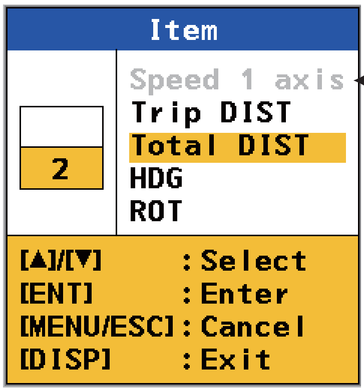
Options available with full screen



Options available with two-way horizontal split screen

Grayed item not available for selection.

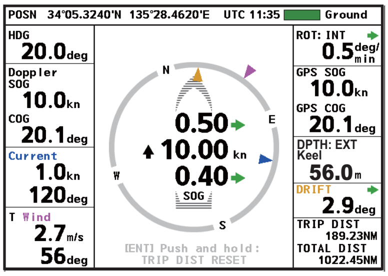
5. Select a data item then press the **ENT** key. See the illustration on the next page for the appearance of the displays.
   For the two-way horizontal split screen, the screen shown below appears after you select the data to show in the top half of the screen. Select a data item for the bottom half of the screen then press the **ENT** key.



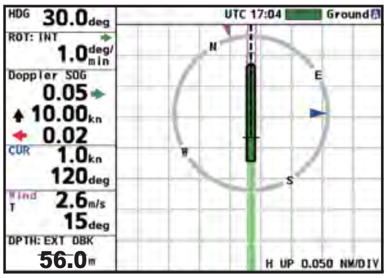
Grayed item not available for selection.

6. Press the **DISP** key to close the menu.

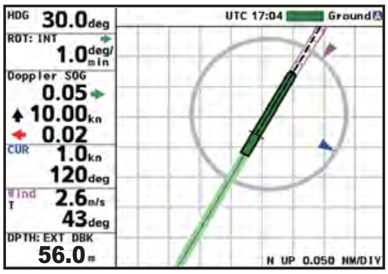
Full-screen displays



Navigation data

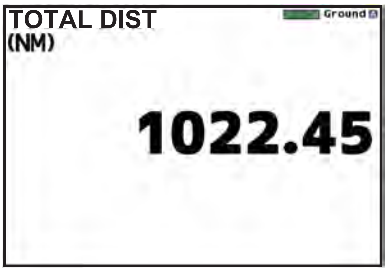


Berthing (Head-up)

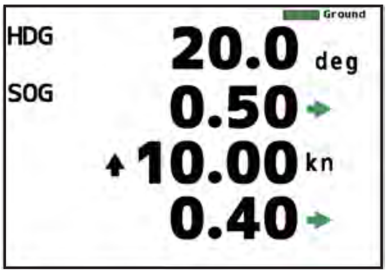


Berthing (North-up)

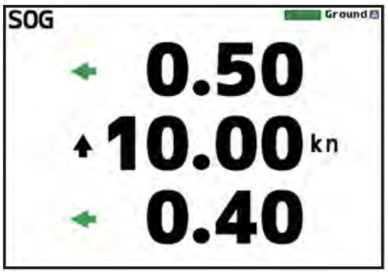
Trip distance



Total distance



Heading and 3-axis speed



3-axis speed

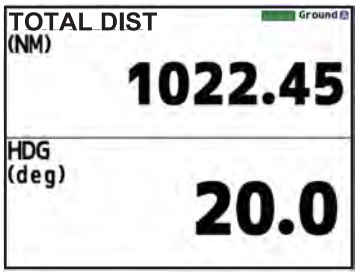
2-axis speed

Speed graphic
(sub display unit only)

1-axis speed
(sub display unit only)

Horizontal split displays

Trip distance, ROT



Total distance, heading

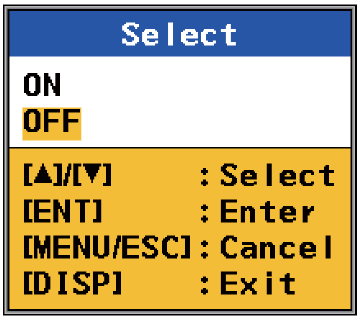
Heading, ROT

Trip distance, total distance

5.2 Key Beep On/Off

A key beeps when it is pressed. You can turn this beep on or off.

1. Press the **MENU/ESC** key to open the menu.
2. Select [Key Beep] then press the **ENT** key.

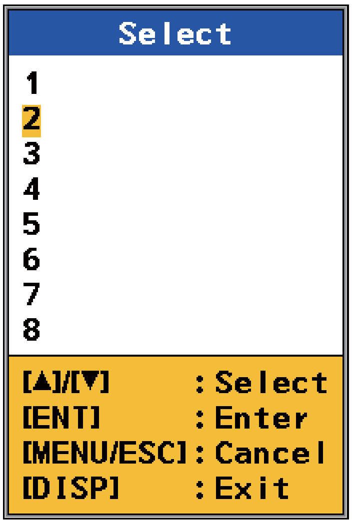


3. Select [ON] or [OFF] then press the **ENT** key.
4. Press the **DISP** key to close the menu.

5.3 How to Adjust Key Dimmer

You can adjust the dimmer for the keys as follows:

1. Press the **MENU/ESC** key to open the menu.
2. Select [Key BRILL] then press the **ENT** key.

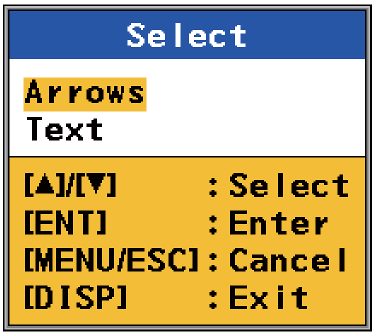


3. Select a dimmer level then press the **ENT** key. The higher the figure, the higher the dimmer level.
4. Press the **DISP** key to close the menu.

5.4 How to Select Direction Symbol Format

The direction symbols for speed and ROT can be shown with arrows or text.

1. Press the **MENU/ESC** key to open the menu.
2. Select [Scale Set Up] then press the **ENT** key.
3. Select [Direction SYM] then press the **ENT** key.



4. Select [Arrows] or [Text] then press the **ENT** key.

Arrows	Text
➡	STBD, S*
⬅	PORT, P*
⬆	FWD
⬇	AFT

* Navigation data display, berthing display

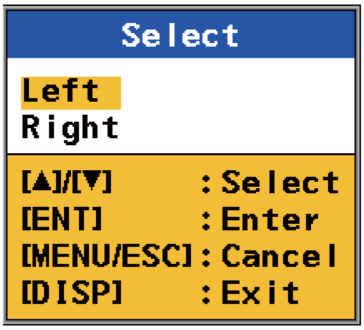
5. Press the **DISP** key to close the menu.

5.5 How to Select the Location for the Direction Symbols

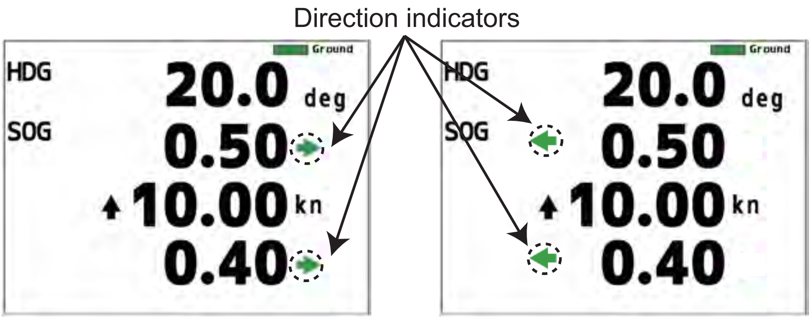
The direction symbols (arrows) for the transverse speeds (reference point, stern) can be displayed on the left or right side of those indications on the digital speed displays. (The ship's speed direction indicator (↑) is on the left always.) This setting does not affect the 3-axis speed display in the navigation data display.

This setting also changes the format for the speed graphic. See section 4.4.

1. Press the **MENU/ESC** key to open the menu.
2. Select [Scale Set Up] then press the **ENT** key.
3. Select [SYM Location] then press the **ENT** key.



4. Select [Left] or [Right] then press the **ENT** key.
   [Left]: The direction indicators are on the right side of the speed indications.
   [Right]: The direction indicators are on the left side of the speed indications.



SYM Location "Left"
(Right-pointing arrow indicates movement in starboard direction when viewed from bow-mounted display unit.)

SYM Location "Right"
(Left-pointing arrow indicates movement in starboard direction when viewed from stern-mounted display unit.)

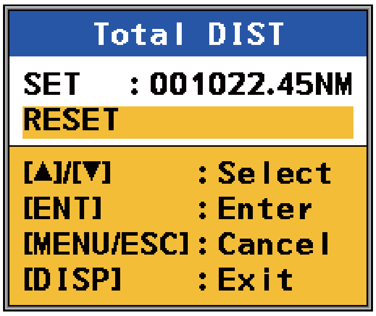
Direction symbols in heading and speed display

5. Press the **DISP** key to close the menu.

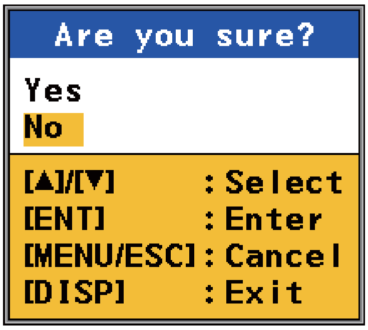
5.6 Total Distance Run

5.6.1 How to reset total distance run

1. Press the **MENU/ESC** key to open the menu.
2. Select [Total DIST] then press the **ENT** key.



3. [RESET] is selected; press the **ENT** key. You are asked if you are sure to reset the total distance run.

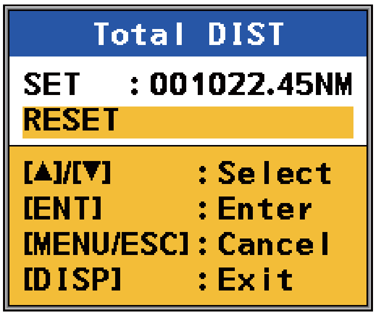


4. Select [Yes] then press the **ENT** key.
5. Press the **DISP** key to close the menu.

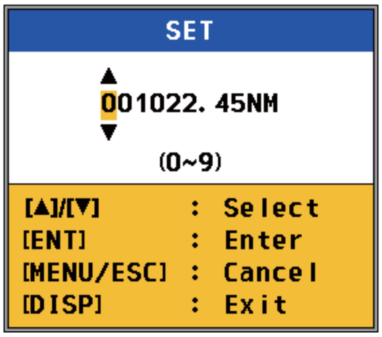
5.6.2 How to set total distance run

The total distance run figure can be adjusted as required.

1. Press the **MENU/ESC** key to open the menu.
2. Select [Total DIST] then press the **ENT** key.



3. Select [SET] then press the **ENT** key.

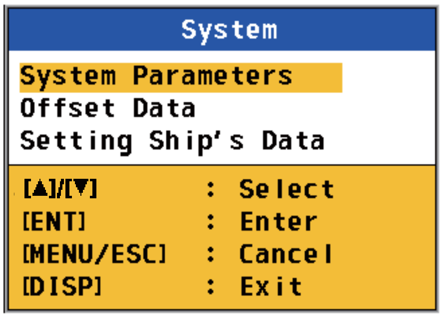


4. Use ▲ or ▼ to set a value then press the **ENT** key. (You can move the cursor to the right with the **ENT** key. Use the **MENU/ESC** key to move the cursor to the left.)
5. Repeat step 4 as required.
6. Press the **DISP** key to close the menu.

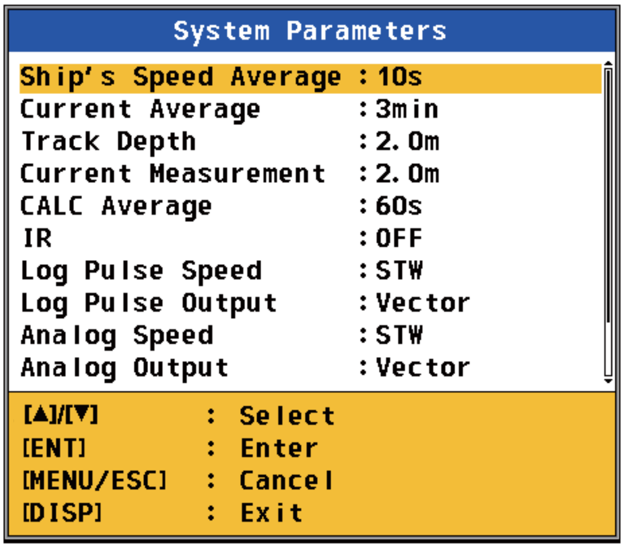
5.7 System Parameters

The [System Parameters] menu provides the functions that once set do not require regular adjustment.

1. Press the **MENU/ESC** key to open the menu.
2. Select [System] then press the **ENT** key.



3. Select [System Parameters] then press the **ENT** key.



System parameters menu description

Item	Description	Available settings
Ship's Speed Average	Set averaging time for ship's speed. The default setting is acceptable for most conditions. If the speed indication is unstable, select the setting that gives stable speed data.	5s, 10s, 15s, 30s, 60s
Current Average	Set averaging time for current (tide) speed and direction. The default setting is acceptable for most conditions. If the current data changes randomly, select the setting that gives stable current data, but does not slow response to changes in current data.	1min, 2min, 3min, 5min, 10min
Track Depth	Set the water tracking depth for measurement of through-the-water-speed. If the through-the-water speed readout is unstable, raise the setting.	0.5 - 25.0(m), 0.1m steps
Current Measurement	Set the depth at which to measure current (tide) speed and direction.	0.5 - 25.0(m), 0.1m steps
CALC Average	Smooth the heading data, which is received every second.	No Averaging, 10s, 30s, 60s, 90s, 120s
IR	Turn the interference rejector on or off. Turn the rejector on when an echosounder is connected to the DS-60, to prevent mutual interference.	ON, OFF
Log Pulse Speed	Select the data to use to calculate distance run.	STW&GPS; SOG&STW&GPS; SOG&GPS; STW
Log Pulse Output	Select the log pulse speed to output to external equipment. • Forward: Forward speed only • Forward-After: Forward and after speeds • Vector: Synthesized speed consisting of forward, after, port and starboard speeds	Forward; Forward-After; Vector
Analog Speed	Select the source for the analog speed indication.	STW&GPS; SOG&STW&GPS; SOG&GPS; STW
Analog Output	Select the analog speed to output to external equipment. • Forward: Forward speed only • Forward-After: Forward and after speeds • Vector: Synthesized speed consisting of forward, after, port and starboard speeds	Forward; Forward-After; Vector
Beam Direction	Select the beam directions to use to measure speed. Forward: 0°, 120°, 240° After: 60°, 180°, 300°	Forward, After
TVG Curve	Used for internal calculations, and the default setting is zero. Do not change the setting. Contact a FURUNO agent or dealer for information.	0 -19

6. MAINTENANCE, TROUBLESHOOTING

This chapter provides the maintenance and troubleshooting information for the operator. If you cannot restore normal operation, do not try to check inside the equipment. Refer any repair work to a qualified technician.

⚠ WARNING

ELECTRICAL SHOCK HAZARD
Do not open the equipment.

This equipment uses high voltage that can cause electrical shock.
0nly qualified persons can work inside the equipment.

NOTICE

Do not apply paint, anti-corrosive sealant or contact spray to plastic parts or equipment coating.

Those items contain products that can damage plastic parts and equipment coating.

6.1 Maintenance

Periodic maintenance is important to keep good performance. Check the system at regular intervals with the procedures shown in the table below.

Item	Check point	Action
Cables	Check that all cables are tightly fastened. Check the cables for corrosion and rust.	Connect loosened cables. Replace any damaged cables.
Cabinet	Dust on the cabinets	Remove dust with a dry, clean cloth. Do not use commercial cleaners to clean any part of the equipment. Commercial cleaners can remove paint and markings.
LCD (display unit)	Dust on the LCD	Wipe the LCD carefully to prevent scratching, using tissue paper and an LCD cleaner. To remove dirt or salt deposits, use an LCD cleaner, wiping slowly with tissue paper so as to dissolve the dirt or salt. Change paper frequently so the salt or dirt will not scratch the LCD. Do not use commercial cleaners to clean any part of the equipment. Commercial cleaners can remove paint and markings.
Transducer	Marine life and growth on the transducer	Marine life and growth on the transducer can reduce sensitivity. When the ship is dry-docked, carefully remove any marine life and growth from the transducer. Paint the transducer yearly with anti-fouling paint (no other type of paint is permitted).

6.2 Consumable Parts

6.2.1 Fuse replacement

The fuse in the Display Unit, Transceiver Unit, Distributor Unit and Rate-of-Turn Gyro protects those units from overvoltage. If you cannot turn on the power, have a technician check if the fuse inside the Display Unit has blown. If the fuse has blown, find the cause before replacing the fuse. If the fuse blows again, contact your dealer.

⚠ WARNING

Use the correct fuse.

A wrong fuse can damage the equipment or cause fire.

Unit	Fuse Rating	Type	Code No.	Qty	Remarks
Display Unit	2A	FGMB 2A AC125V PBF	000-157-479-10	1	Inside unit
Transceiver Unit	3A	FGB01 3A AC250V PBF	000-155-841-10	2	Inside unit
Distributor Unit	5A	FGB01 5A AC250V PBF	000-155-840-10	2	Inside unit
Rate-of-Turn Gyro	2A	FGB01 2A AC250V PBF	000-155-829-10	1	Inside unit

6.2.2 Product life

Unit	Approx. Life (@55°C)	Replacement Part
DS-600 Backlight	30,000 h	Panel assy.: DS-600 (001-098-070-00)
DS-670 Rate-of-Turn Gyro (Fiber Optic Gyro)	17,520 h	Model: HOFG-1F (VER1.0)

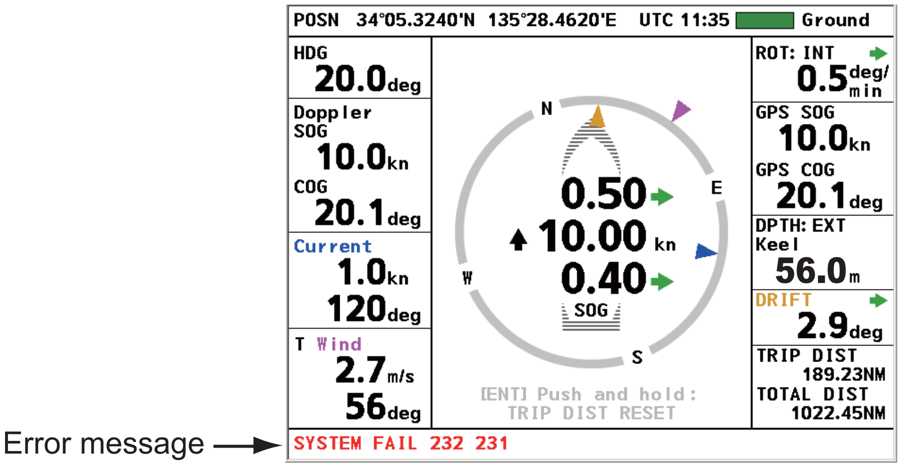
6.3 Troubleshooting

This section provides the troubleshooting procedures that the user can follow to restore normal operation. If you cannot restore normal operation, contact a qualified FURUNO technician for instruction.

Problem	Possible cause	Action
General		
The power cannot be turned on.	Loosened power cable.	Fasten the power cable.
	Blown fuse.	Get a qualified technician to check the fuse in the display unit. Replace the fuse if it has blown.
The power is on, but the screen is black.	The brilliance is too low.	Increase the brilliance.
Doppler speed indication		
The indication does not change (display has frozen) and the speed unit is red.	• Air bubbles on the transducer face. • The ground tracking mode is used when the depth is 200 m or more.	• Wait for the air bubbles to disappear. • Select the water tracking mode or auto mode.
The indication shows "-.--"	• Air bubbles on the transducer face. • The ground tracking mode is in use when the depth is 200 m or more.	• Wait for the air bubbles to disappear. If the problem continues, check the transducer. • Select the water tracking mode or auto mode.
GPS speed, position indication		
The indication shows "-.--"	GPS data error.	Check the GPS receiver.
The indication shows hyphens (-) at digit locations.	The GPS receiver is disconnected.	Check the GPS receiver.

6.4 Error Messages

The Distributor Unit monitors the system for error. When an error occurs, the audible alarm sounds and an error message appears at the bottom of the display. You can stop the audible alarm with the **ALARM ACK** key. The error message remains on the screen until the reason for the error message is removed.



The table below shows all the error messages that can appear on the display.

Error category	Unit, error		Error code
POWER FAIL	—		100
SYSTEM FAIL	DS-620	B voltage circuit	210
		B voltage	211
		+5V voltage	212
		+12 voltage	213
	DS-670	Temperature (high)	220
		Optical line	221
		PI control	222
	DS-610	Communication with DS-600	231
		Communication with DS-620	232
SPEED ALARM		Speed alarm	300
ECHO FAIL		Echo	310

The system displays one error message. If many errors occur at the same time, the most important error message is displayed. See the table below for error message and priority.

Error				Error message
POWER FAIL	SYSTEM FAIL	SPEED ALARM	ECHO FAIL	
Alarm	—	—	—	POWER FAIL 100
No alarm	Alarm	—	—	SYSTEM FAIL 2xx
No alarm	No alarm	Alarm	No alarm	SPEED ALARM 300
No alarm	No alarm	No alarm	Alarm	ECHO FAIL 310
No alarm	No alarm	Alarm	Alarm	SPEED ALARM 300 ECHO FAIL 310

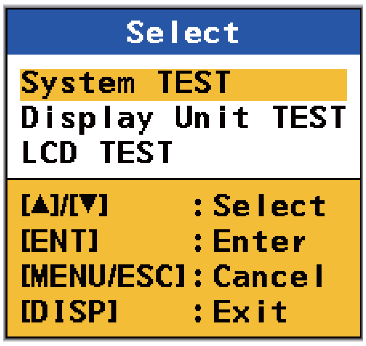
6.5 Diagnostics

The DS-60 has tests that check the system (Display Unit, Distributor Unit, Transceiver Unit), Display Unit only, and LCD.

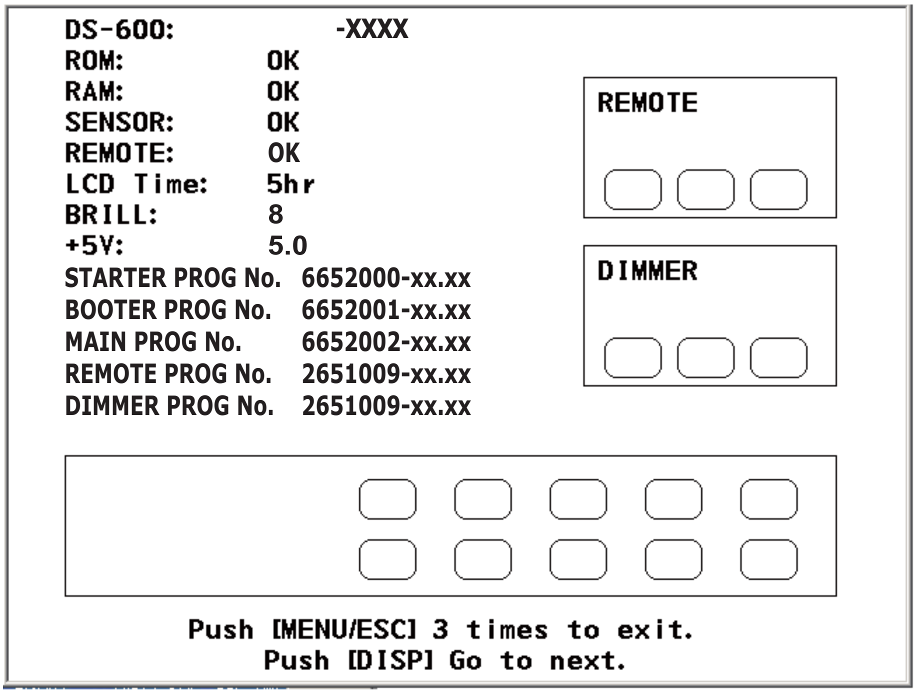
6.5.1 System test

The system test checks the Display Unit, Distributor Unit and Transceiver Unit for correct operation.

1. Press the **MENU/ESC** key to open the menu.
2. Select [TESTS] then press the **ENT** key.



3. Select [System TEST].
4. Press the **ENT** key. The results of the display unit test appear.



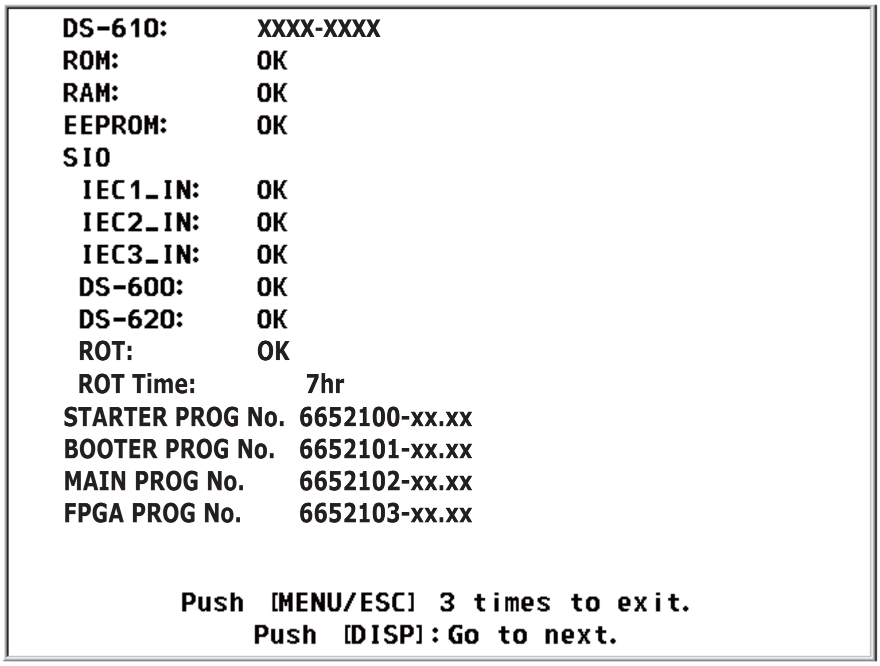
Description of test results for the Display Unit DS-600

- The results of the ROM and RAM check are shown as OK (normal) or NG (No Good). For any NG, reset the power and try the test again. If the NG condition continues, contact your dealer for instruction.
- "SENSOR" shows the results of the connection test with DS-610. OK for normal, no indication if there is error.

- "REMOTE" shows the results of the connection test with the Remote Controller and Dimmer Controller. Operate the Remote Controller and Dimmer Controller. OK appears if an operation is completed correctly. If the results location is blank, there is no connection or there is no operation from the remote device.
- "LCD Time" shows how many hours the LCD has been on, up to a maximum of 999,999 hours.
- "BRILL" shows the current LCD brilliance setting. Press ▲, ▼. Check that the indication and brilliance level agree.
- "+5V" shows the voltage of the +5.0V circuit.
- The program number of the starter program, booter program, main program, remote program and dimmer program are shown. (The program no. indication is blank where no equipment is not connected.)

The rectangles on the screen are for testing the controls of the Display Unit, Remote Controller and Dimmer Controller. Press any key except the **PWR** and **DISP** keys. The key's on-screen rectangle fills in red if the key is normal. Press the key again and the red fill is removed.

5. Press the **DISP** key to test the Distributor Unit DS-610.



<u>**Description of test results for the Distributor Unit DS-610**</u>

- The results of the ROM, RAM and EEPROM check are shown as OK or NG. For any NG, reset the power and try the test again. If the NG condition continues, contact your dealer.
- The input signals connected to the input ports IEC1 - IEC3 are checked and the results are shown as OK for normal, or no indication if there is no connection.
- The items DS-600, DS-620 and ROT show the results of the connection tests between those units and the DS-610. OK for normal, or no indication for error.
- "ROT Time" shows the number of hours that the Rate-of-Turn Gyro has been powered. The maximum time is 999,999 hours. No indication if there is no connection.
- The program number of the starter program, booter program, main program and FPGA program are shown.

6. Press the **DISP** key to test the Transceiver Unit DS-620.

```
DS-620:            -XXXX
ROM:               OK
RAM:               OK
SIO
 DS-610:
B Volt:            122.4
+5V:               5.0
+12V:              12.2
STARTER PROG No.     6652200-xx.xx
BOOTER PROG No.      6652201-xx.xx
MAIN PROG No.        6652202-xx.xx
FPGA1 PROG No.       6652203-xx.xx
FPGA2 PROG No.       6652204-xx.xx

        Push [MENU/ESC] 3 times to exit.
            Push [DISP] Go to next.
```

Description of test results for the Transceiver Unit DS-620

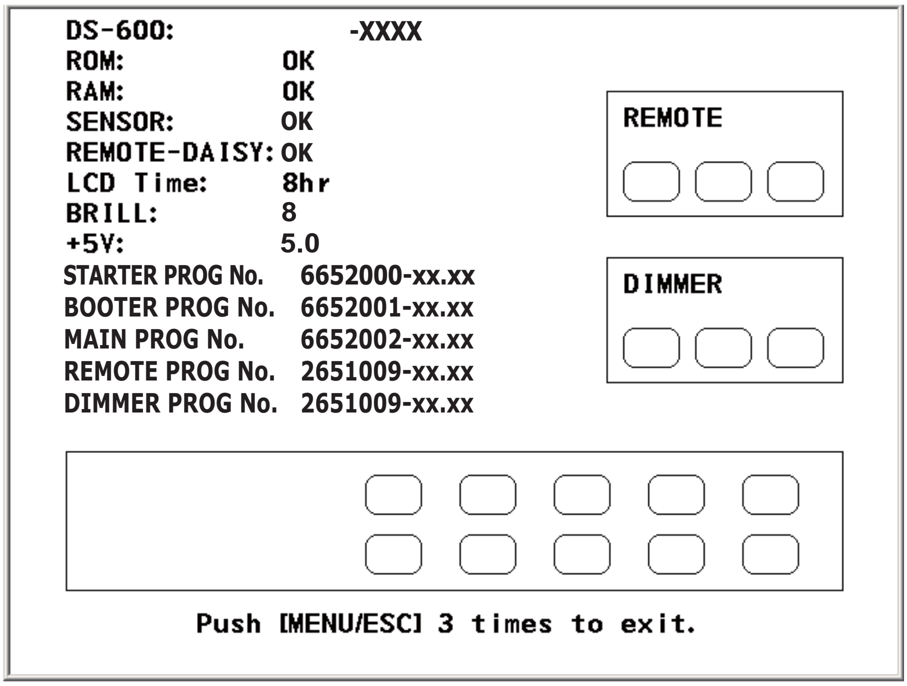
- The results of the ROM and RAM check are shown as OK or NG. For any NG, reset the power and try the test again. If the NG condition continues, contact your dealer for instruction.
- "DS-610" shows the results of the connection test with the DS-610. OK for normal, or no indication for error.
- "B Volt", "+5V" and "+12V" show the voltage of the related circuits.
- The program number of the starter program, booter program, main program FPGA1 program and FPGA2 program are shown.

7. To quit the self test, press the **MENU/ESC** key three times.

6.5.2 Display unit test

Do the display unit test to check the display unit for correct operation.

1. Press the **MENU/ESC** key to open the menu.
2. Select [TESTS] then press the **ENT** key.
3. Select [Display Unit TEST].
4. Press the **ENT** key, and the results of the display unit test appear.



Description of test results for the Display Unit DS-600

- The results of the ROM and RAM check are shown as OK (normal) or NG (No Good). For any NG, reset the power and try the test again. If the NG condition continues, contact your dealer for instruction.
- "SENSOR", "REMOTE-DAISY" show the results of the serial loopback test, which requires a special test connector. OK for normal, no indication if there is error.
- "LCD Time" shows how many hours the LCD has been powered, up to a maximum of 999,999 hours.
- "BRILL" shows the current LCD brilliance setting. Press ▲, ▼ to check the brilliance control circuit. Check if the indication and brilliance level agree.
- "+5V" shows the voltage of the +5.0V circuit.
- The program number of the starter program, booter program, main program, remote program and dimmer program are shown. (The program no. indication is blank where no equipment is not connected.)

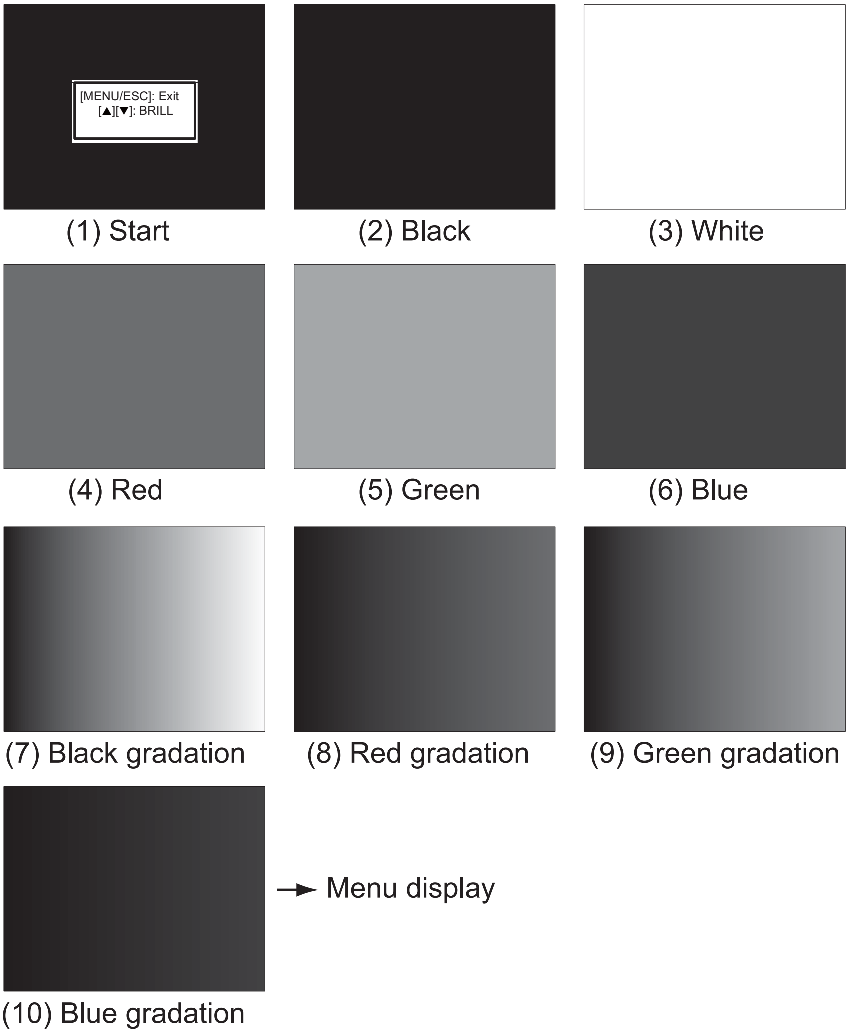
The rectangles on the screen are for testing the controls of the Display Unit, Remote Controller and Dimmer Controller. Press any key except the **PWR** and **DISP** keys. The key's on-screen rectangle fills in red if the key is normal. Press the key again and the red fill is removed.

5. To quit the self test, press the **MENU/ESC** key three times.

6.5.3 LCD test

The LCD test checks the LCD and the brilliance control circuit.

1. Press the **MENU/ESC** key to open the menu.
2. Select [TESTS] then press the **ENT** key.
3. Select [LCD TEST] then press the **ENT** key.
4. Press any key except the **MENU/ESC** key or ▲,▼ to display each color, in the order shown in the figure below. To test the brilliance control circuit, press ▲,▼.

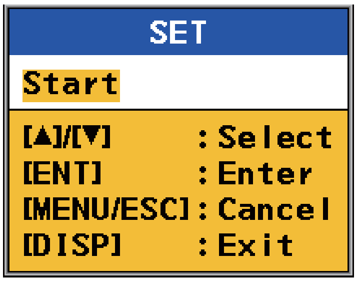


5. Control is returned to the menu after the blue gradation is shown. Press the **DISP** key to close the menu.

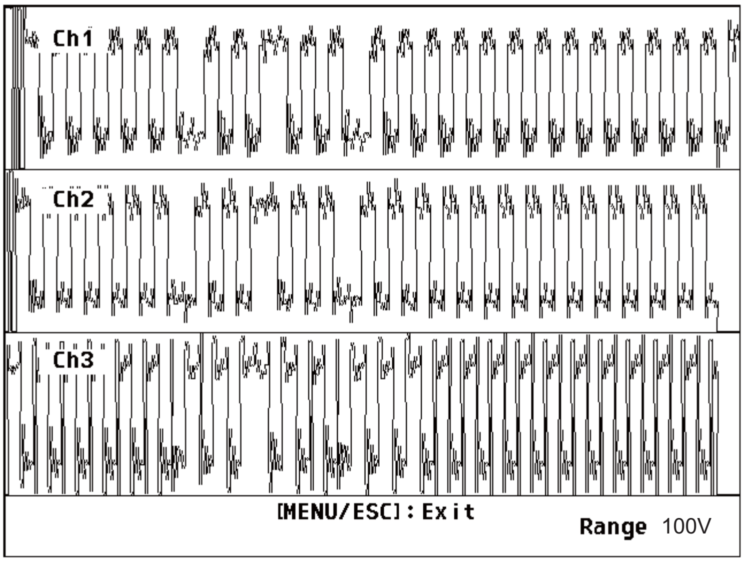
6.6 TX Monitor

The serviceman uses the TX monitor feature to see the TX condition by amplitude and cycle of waveform.

1. Press the **MENU/ESC** key to open the menu.
2. Select [TX Monitor] then press the **ENT** key.



3. [Start] is selected; press the **ENT** key to show the TX monitor display.

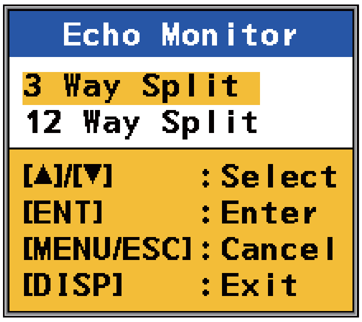


4. To quit the TX monitor, press the **MENU/ESC** key.

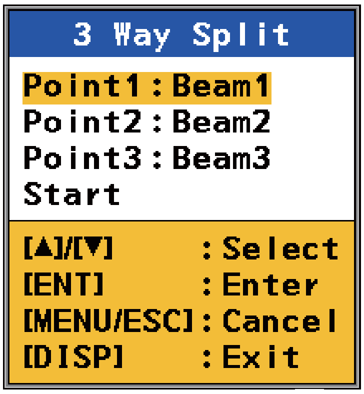
6.7 Echo Monitor

The serviceman uses the echo monitor feature to see RX condition. If the image from the received beams or channels appear equal, the reception is normal.

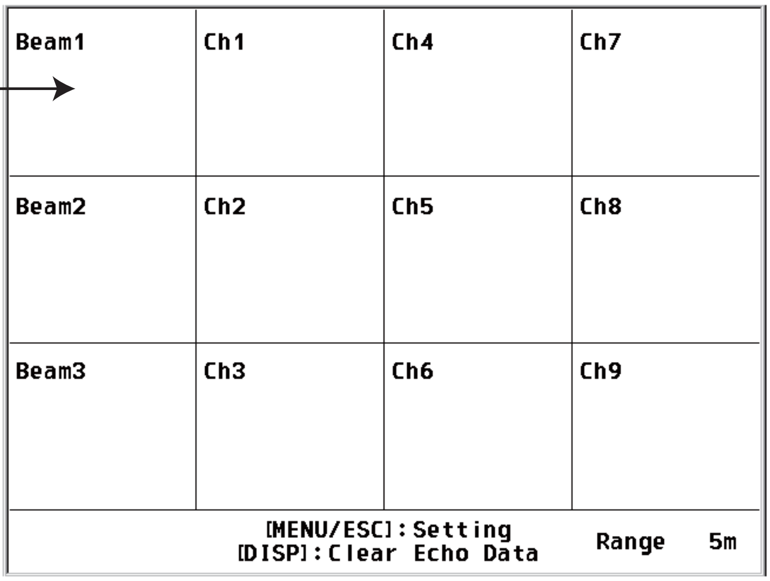
1. Press the **MENU/ESC** key to open the menu.
2. Select [Echo Monitor] then press the **ENT** key.



3. Select [3 Way Split] or [12 Way Split].
   3 Way Split: Select beams (1-3) and/or channels (1-9) to monitor. You can select any three to monitor.
   12 Way Split: Monitor all beams (1-3) and all channels (1-9).
4. Press the **ENT** key. One of the following displays appears depending on the selection you made at step 3.



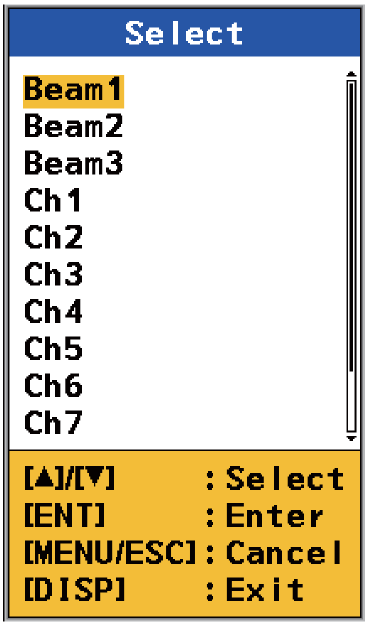
3-way split



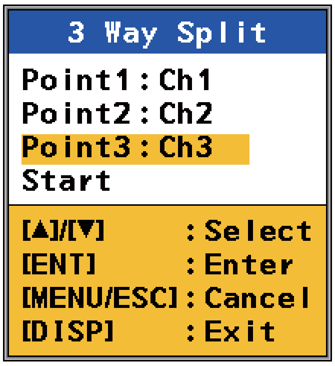
12-way split

For [12 Way Split] go to step 5. To clear the echo data, press the **DISP** key.
For [3 Way Split], do the following:

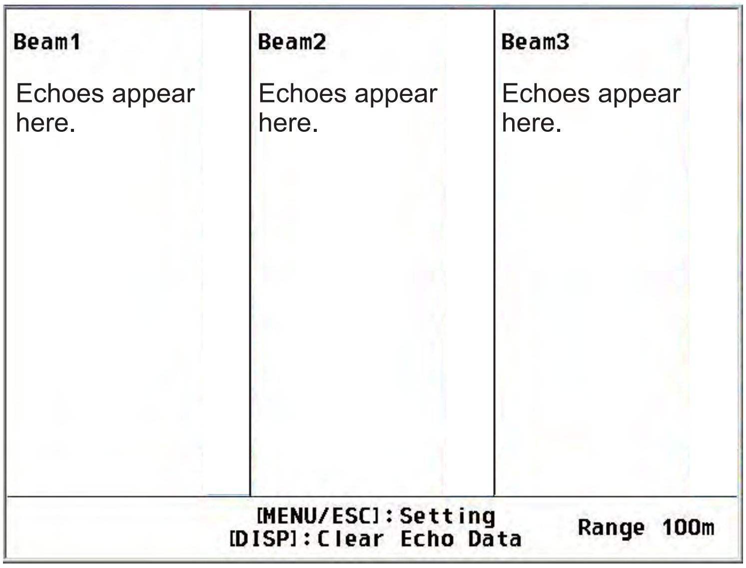
1) [Select Point1] then press the **ENT** key.



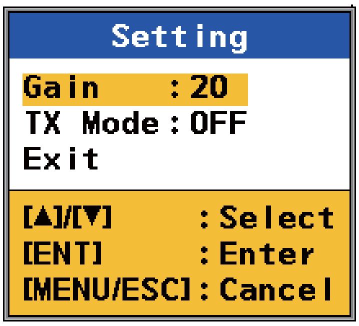
2) Select the beam or channel to display then press the **ENT** key.
3) Select the beam or channel for [Point2] and [Point3] in the same method.
4) After you selected the beams or channels to show for [Point3], the following screen appears.



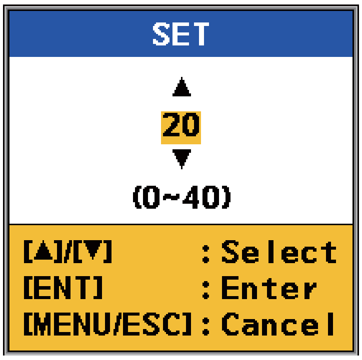
5) Select [Start] then press the **ENT** key. The display now shows the echoes from the beams (or channels) selected.



5. To change the range, press the **RNG** key. The available ranges are (in meters) 5, 10, 20, 40, 100, 200 and 300. The current range is shown at the bottom right corner on the echo monitor display.
6. To clear the echo data, press the **DISP** key.
7. The [Setting] menu controls the gain, TX mode and exit from the echo monitor. At the echo monitor display, press the **MENU/ESC** key to show the [Setting] menu.



1) You can change the gain to see the echoes under different gain settings. Select [Gain] then press the **ENT** key.



2) Use ▲ or ▼ to set the gain then press the **ENT** key.
3) [TX Mode] on the [Setting] menu stops or starts transmission. [ON] transmits, [OFF] stops transmission. Use [OFF] to monitor noise.

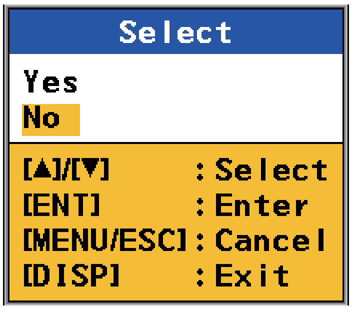
4) To monitor other beams or channels, select [Exit] then press the **ENT** key to return to the echo monitor menu.
5) To close the [Setting] menu and return to the echo monitor display, press the **MENU/ESC** key.

8. To quit the echo monitor, press the **MENU/ESC** key to show the [Setting] menu, select [Exit] then press the **ENT** key.

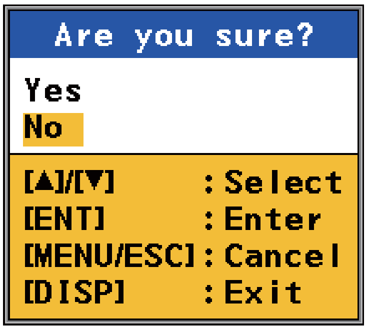
6.8 How to Restore Initial Settings

If you feel the equipment is not operating correctly, one cause can be abnormal equipment settings. Try restoring initial settings to restore normal operation. All initial settings are restored, however trip distance and total distance run are not reset.

1. Press the **MENU/ESC** key to open the menu.
2. Select [User RESET] then press the **ENT** key.



3. Select [Yes] then press the **ENT** key.



4. Select [Yes] then press the **ENT** key to restore initial settings.

APPENDIX 1 MENU TREE

- MENU key
  - Ship's Time
    - Source (Internal(-13:00 - +13:00), ***NAV EQUIP***)
    - Summer Time (ON, ***OFF***)
  - Trip DIST*1 (SET(000000.00 - 999999.99(NM), RESET)
  - Ship's Track (***Past+Predict***, Past, Predict, OFF)
  - Plot Time (1min, 2min, ***5min***, 10min, 20min, 30min)
  - Past Tracks (***ON***, OFF)
  - Vector Time (30s, 1min, 2min, ***5min***, 10min, 20min)
  - Display (DISP1 - DISP7, arrange displays)
    - DISP 1: ***Navigation***
    - DISP 2: ***Berthing H Up***
    - DISP 3: ***HDG.Speed 3-axis***
    - DISP 4: ***Trip DIST + Total DIST***
    - DISP 5: ***Main, no display, Sub, Speed Graphic***
    - DISP 6, DISP7: ***No display***
  - Scale Set Up
    - Speed Graphic*2
      - DISP1
      - DISP2 - DISP7
        - Astern SPD Scale (***5kn (2.5m/s, 10km/h***), 10kn (5.0m/s, 20km/h), 15kn (7.5m/s, 30km/h), 20kn (10.0m/s, 40km/h), 25kn (12.5m/s, 50km/h), 30kn (15.0m/s, 60km/h), 35kn (17.5m/s, 70km/h)
        - Ahead SPD Scale (same choices as above, ***25kn (12.5m/s, 50km/h***)
    - Depth REF (***EXT DBK***, EXT DBT, INT DBT)
    - Direction SYM (***Arrows***, Text)
    - SYM Location (***Left***, Right)
    - Berthing Range (***50m (0.025NM)***, ***75m (0.040NM)***, ***100m (0.050NM)***, ***150m (0.075NM)***, ***200m (0.100NM)***, 250m (0.125NM), 300m (0.150NM), 400m (0.200NM), 600m (0.300NM), 800m (0.400NM), 1000m (0.500NM), Save)
    - Berthing Data Display (***3 axis in NAV***, 3 axis and NAV, 3 axis)
    - CUR Direction (***Flow to***, Flow from)
    - Mode
      - Wind (***True***, Theoretical, Relative)
      - Time (***UTC***, Ship's Time)
  - Initialize
  - Total DIST*1 (SET(0 - 999,999.99(NM)), RESET)
  - Speed Limit Alarm*1 (SET, ***40.0kn*** (0.00 - 40.00(kn)), ***OFF***)
  - Berthing Line*1 (***Edit***, Share, Delete)
  - Wind Average (No Averaging, ***1min***, 2min, 3min, 5min, 10min)
  - Key Beep (***ON***, OFF)
  - Key BRILL (1, ***2***, 3, 4, 5, 6, 7, 8)
  - Speed Select*2 (***Forward-After***, Vector)
  - Echo Monitor*1
    - 3 Way Split
    - 12 Way Split
      - Point 1 (***Beam 1***, Beam 2, Beam 3, Ch1, Ch2, Ch3, Ch4, Ch5, Ch6, Ch7, Ch8, Ch9)
      - Point 2 (Same choices as Point 1. ***Beam 2***)
      - Point 3 (Same choices as Point 1. ***Beam 3***)
      - Start
  - TX Monitor*1 (Start)
  - ROT Sensor*1 (***Internal***, External ROT, External HDG)
  - TESTS (System TEST, Display Unit TEST, LCD TEST)

*1 Main display unit only
*2 Sub display unit only

(Continued on next page)

(Continued from previous page)

- System*1
  - System Parameters
    - Ship's Speed Average (5s, ***10s***, 15s, 30s, 60s)
    - Current Average (1min, 2min, ***3min***, 5min, 10min)
    - Track Depth (0.5 - 25.0 (m); ***1.0m***)
    - Current Measurement (0.5 - 25.0 (m); ***2.0m***)
    - CALC Average (No Averaging, 10s, 30s, ***60s***, 90s, 120s)
    - IR (ON, ***OFF***)
    - Log Pulse Speed (***STW&GPS***, SOG&STW&GPS, SOG&GPS, STW)
    - Log Pulse Output (Forward, ***Forward-After***, Vector)
    - Analog Speed (***STW&GPS***, SOG&STW&GPS, SOG&GPS, STW)
    - Analog Output (Forward, ***Forward-After***, Vector)
    - Beam Direction (***Forward***, After)
    - TVG Curve (0 - 19; ***0***)
  - Offset Data*2
    - Trim (-12.5 deg - +12.5 deg)
    - Heel (-12.5 deg - +12.5 deg)
    - XDCR (-60.0 deg - +60.0 deg)
    - Compass Calibration (-12.5 deg - +12.5 deg)
    - SOG Calibration (-12.5% - +12.5%)
    - STW Calibration (-12.5% - +12.5%)
  - Setting Ship's Data*2
    - LOA (50.0m - 400.0m)
    - B (5.0m - 100.0m)
    - L1 (0.0m - LOA)
    - L2 (0.0m - B)
    - L3 (0.0m - LOA)
    - L4 (0.0m - B)
    - L5 (0.0m - LOA)
    - D (0.0m - LOA-L1)
- User RESET (Yes, ***No***)

*1 Main display unit only
*2 See installation manual

APPENDIX 2 DIGITAL INTERFACE

Input sentences

DBT, DPT, GGA, GLL, GNS, HDG, HDT, MWV, RMC, ROT, VTG, ZDA

Output sentences

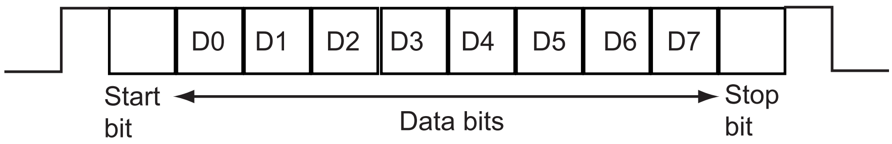
VBW, VDR, VHW, VLW, VTG

Data reception

Data is received in serial asynchronous form in accordance with the standard referenced in IEC 61162-2.

The following parameters are used:

- Baud rate
  Input: 38,400 bps, IEC 61162-2-1, 4800 bps, IEC 61162-1-2
  Output: Same as above. Baud rate fixed at 38400 bps for DS-600.
- Data bits: 8 (D7 = 0), Parity: none, Stop bits: 1



Data sentences: Input

Data format is IEC 61162-1 Edition 3 unless noted otherwise.

DBT - Depth below transducer

```
$ ** DBT,    x.x, f, x.x, M, x.x, F *hh <CR><LF>
              1   2 3    4    5   6
```

1, 2 Water depth, feet
3, 4 Water depth, m
5, 6 Water depth, fathom

DPT - Depth

```
$ ** DPT, x.x, x.x, x.x, *hh <CR><LF>
           1     2    3
```

1. Water depth relative to transducer, in meters
2. Offset from transducer, in meters
3. Maximum range scale in use

GGA - Global Positioning System Fix Data

```
$ ** GGA, hhmmss.ss, llll.ll, a, yyyyy.yy, a, x, xx, x.x, x.x, M, x.x, M, x.x, xxxx *hh <CR><LF>
                1          2   3       4     5  6  7    8    9  10   11 12  13   14
```

1. UTC (no use)
2. Latitude, N/S
3. N/S
4. GPS quality indicator
5. E/W
6. Quality index
7. Satellites used (no use)
8. DOP (no use)
9. Antenna height above the sea level (no use)
10. Unit (M) (no use)
11. Geoid height (no use)
12. Unit (M) (no use)
13. Age of differential GPS date (no use)
14. Differential reference station ID (no use)

GLL - Geographic position

```
$ ** GLL, llll.ll, a, yyyyy.yyy, a, hhmmss.ss, x, x *hh <CR><LF>
             1     2      3      4       5       6  7
```

1. Latitude
2. N/S
3. Longitude
4. E/W
5. UTC of Position
6. Status (A: Data valid, V: Data not valid)
7. Mode indicator (A: Autonomous, D: Differential mode, S: Simulator mode)

GNS - GNSS Fix Data

```
$ ** GNS, hhmmss.ss, llll.ll, a, yyyyy.yyy, a, cc, xx, x.x, x.x, x.x x.x, x.x *hh <CR><LF>
              1          2   3       4      5   6   7   8    9   10  11   12
```

1. UTC of position (no use)
2. Latitude
3. N/S
4. Longitude
5. E/W
6. Mode indicator (N=No fix, A=Autonomous, D=Differential, P=Precise, R=Real Time Kinetic, F=Float RT
   E=Estimated Mode, M=Manual Input Mode, S=Simulator Mode
7. Total number of satllite in use (no use)
8. HDOP (no use)
9. Antenna altitude (no use)
10. Geoidal separation (no use)
11. Age of differential data (no use)
12. Differential reference station ID (no use)

HDG - Heading, Deviation and Variation

```
$ ** HDG, x.x, x.x, a, x.x, a *hh <CR><LF>
           1    2  3  4   5
```

1. Magnetic sensor heading, degrees
2. Magnetic deviation, degrees
3. Magnetic variation, degrees E/W
4. Magnetic deviation, degrees
5. Magnetic variation, degrees E/W

HDT - Heading True

```
$ ** HDT, xxx.x, T *hh <CR><LF>
            1    2
```

1. Heading, degrees
2. True

MWV - Wind Speed and Angle

```
$ ** MWV, x.x, a, x.x, a, A *hh <CR><LF>
           1   2   3   4 5
```

1. Wind angle (degrees)
2. Reference, R=relative, T=true
3. Wind speed
4. Wind speed units, K/M/N
5. Status, A=data valid, V=data invalid

RMC - Recommended Minimum Specific GNSS Data

```
$ ** RMC, hhmmss.ss A, llll.ll, a, yyyyy.yy, a, x.x, x.x, xxxxxx, x.x, a, a, *hh <CR><LF>
              1     2    3   4       5      6   7    8      9     10 1112
```

1. UTC of position fix (no use)
2. Status: A=data valid, V=navigation receiver warning
3. Latitude
4. N/S
5. Longitude
6. E/W
7. Speed over ground, knots
8. Course over ground, degrees true
9. Date: dd/mm/yy (no use)
10. Magnetic variation, degrees E/W (no use)
11. E/W
12. Mode indicator (A=Autonomous mode, D=Differential mode, S=Simulator mode)

ROT - Rate of Turn

```
$ ** ROT, x.x, A *hh <CR><LF>
           1   2
```

1. Rate of turn, deg/min, "-"=bow turns to port
2. Status: A=data valid, V=data invalid

VTG - Course over the ground and ground speed

```
$ ** VTG, x.x, T, x.x, M, x.x, N, x.x, K, a *hh <CR><LF>
          1   2  3    4   5    6  7    8 9
```

1. Course over ground, degrees true
2. T
3. Course over ground, degrees magnetic (no use)
4. M (no use)
5. Speed over ground, knots
6. N
7. Speed over ground, km/h
8. K
9. Mode indicator (A=Autonomous, D=Differential, S=Simulator)

ZDA - Time and date

```
$ ** ZDA, hhmmss.ss, xx, xx, xxxx, xx, xx *hh <CR><LF>
              1       2   3    4    5   6
```

1. UTC
2. Day, 01 to 31(UTC)
3. Month, 01 to 12(UTC)
4. Year(UTC)
5. Local zone hours, 00 to ±13
6. Local zone minutes, 00 to +59

Data sentences: Output

VBW - Dual ground/water speed

```
$ ** VBW, x.x, x.x, A, x.x, x.x, A, x.x, A, x.x, A, *hh <CR><LF>
           1    2   3  4     5   6   7   8   9  10
```

1. Longitudinal water speed, knots
2. Transverse water speed, knots
3. Status: water speed (A=data valid, V=data invalid)
4. Longitudinal ground speed, knots
5. Transverse ground speed, knots
6. Status: ground speed (A=data valid, V=data invalid)
7. Stern water speed, knots
8. Status: stern water speed (A=data valid, V=data invalid)
9. Stern transverse ground speed, knots
10. Status: stern transverse ground speed (A=data valid, V=data invalid)

VDR - Set and Drift

```
$ ** VDR, x.x, T, x.x, M, x.x, N, *hh <CR><LF>
          1    2  3    4  5    6
```

1. Direction, degree True
2. T
3. Direction, degree Magnetic
4. Magnetic
5. Current speed, knots
6. N

VHW - Water Speed and Heading

```
$ ** VHW, x.x, T, x.x, M, x.x, N, x.x, K *hh <CR><LF>
          1    2  3    4  5    6  7    8
```

1. Heading, degrees true
2. T
3. Heading, degrees magnetic (no use)
4. (no use)
5. Speed, knots
6. N
7 Speed, km/h
8. K

VLW - Dual Ground/Water Distance

```
$ ** VLW, x.x, N, x.x, N, x.x, N, x.x, N, *hh <CR><LF>
          1    2  3    4  5    6  7    8
```

1. Total cumulative water distance, nautical miles
2. Nautical miles
3. Water distance since reset
4. Nautical miles
5. Total cumulative ground distance (no use)
6. nautical miles (no use)
7. Ground distance since reset (no use)
8. Nautical miles (no use)

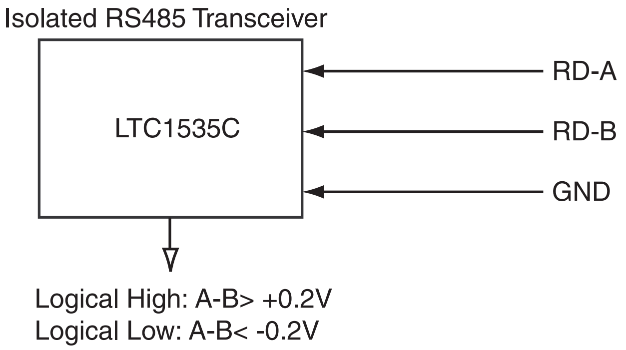
VTG - Course Over the Ground and Ground Speed

See VTG at input sentences section.

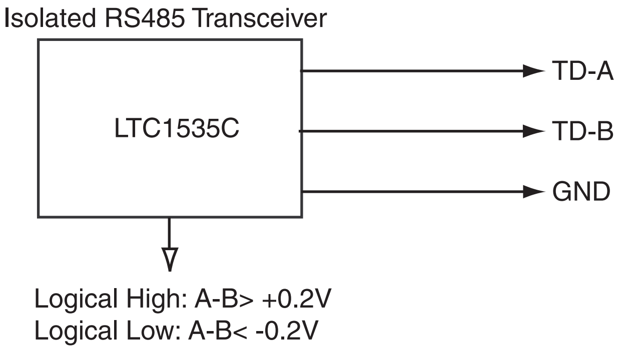
Serial Interface

Baud rate is selectable from 4800 bps and 38400 bps. The serial interface complies with IEC 61162-2.

Input port (RD-A, RD-B)



Output port (TD-A, TD-B)



APPENDIX 3 ABBREVIATIONS

Below is a list of abbreviations used in this manual and in the DS-60.

General

Abbreviation	Meaning
ACK	Acknowledge
ADJ	Adjustment
AFT	After
ALARM	Alarm
AUTO	Automatic
B	Breadth
BRILL	Brilliance
CALC	Calculate
CCRP	Consistent Common Reference Point
COG	Course Over The Ground
CUR	Current
DBK	Depth Below Keel
DBT	Depth Below Transducer
DEL	Delete
DISP	Display
DIST	Distance
DPTH	Depth
DRIFT	Drift Angle
E	East
ENT	Enter
ESC	Escape
EXT	External
FAIL	Fail
FWD	Forward
GAIN	Gain
GPS	Global Positioning System
H UP	Head Up
HDG	Heading
IR	Interference Rejector
INT	Internal
I/O	Input/Output
L	Length
LAT	Latitude
LCD	Liquid Crystal Display
L/L	Latitude/Longitude
LOA	Length Overall
LON	Longitude
MAX	Maximum
MIN	Minimum
MODE	Mode
N	North
NAV	Navigation

Abbreviation	Meaning
NG	No Good
NT	Night
N UP	North Up
P	Port
POSN	Position
PRED	Predicted
PWR	Power
R	Relative
RAM	Random Access Memory
REF	Reference
RNG	Range
ROT	Rate Of Turn
ROM	Read Only Memory
S	South
S	Starboard
SEL	Select
SIM	Simulation
SOG	Speed Over The Ground
SPD	Speed
STBD	Starboard
STW	Speed Through The Water
SYM	Symbol
T	True
Trim	Trim
UTC	Coordinated Universal Time
Trip	Trip
TRK	Track
TVG	Time Variable Gain
TX	Transmit
VECT	Vector
WPT	Waypoint
W	West
XDCR	Transducer

Unit

Abbreviation	Meaning
deg or °	degree(s)
fm	fathom(s)
ft	feet / foot
hrs	hours
km	kilometer(s)
kn	knot(s)
m	meter(s)
min or ’	minute(s)
NM	nautical mile(s)
s or “	second(s)

APPENDIX 4 PARTS LIST, PARTS LOCATION

This chapter shows only the modules/components/parts that can be replaced in shipboard maintenance (IMO A.694(17)/8.3.1). Main modules are shown on the parts location illustrations, which follow the parts list.

Parts List

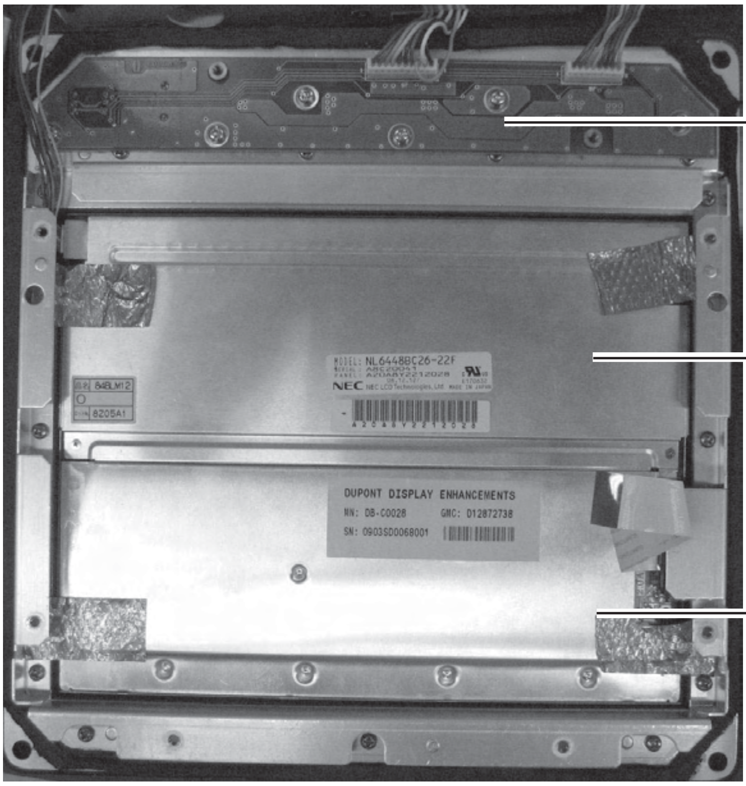
2011/4

Model	DOPPLER SONAR DS-60
Unit	DISPLAY UNIT DS-600 DISTRIBUTOR UNIT DS-610 TRANSCEIVER UNIT DS-620 JUNCTION BOX DS-640 JUNCTION BOX DS-645A JUNCTION BOX DS-645B REMOTE CONTROLLER RD-501 DIMMER CONTROLLER RD-502

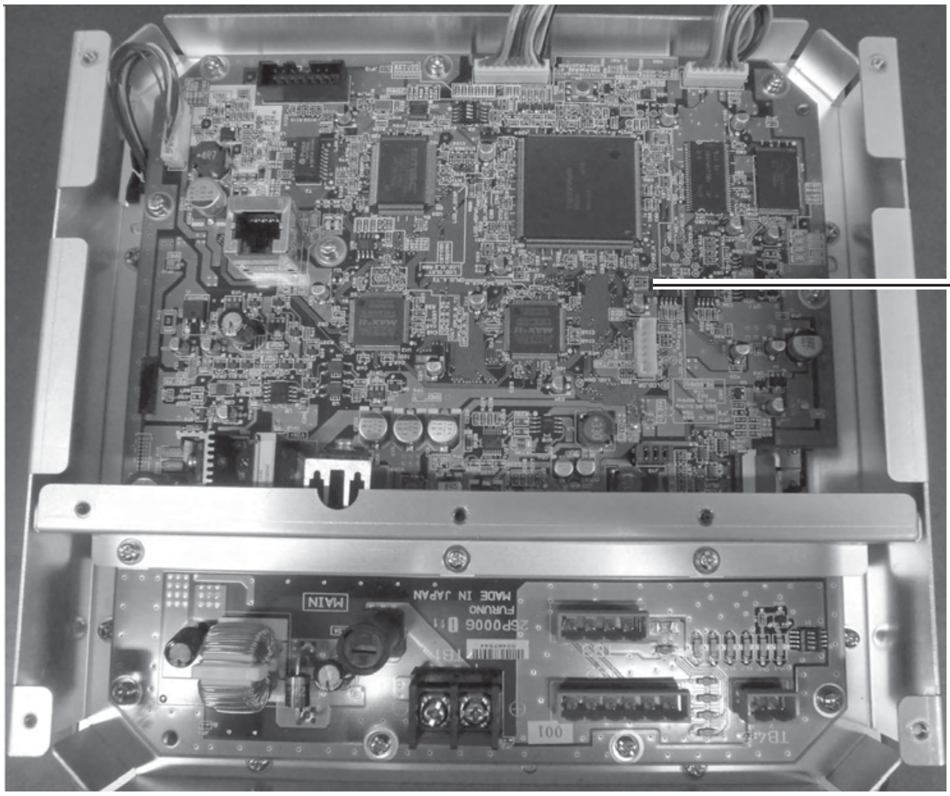
UNIT	PRINTED CIRCUIT BOARD/ ASSY. TYPE	CODE NO.
DISPLAY UNIT DS-600		
MAIN BOARD	26P0006	001-098-030
PNL BOARD	26P0007	001-098-050
MCN BOARD	02P6345	001-098-080
LCD	NL6448BC26-22F	000-171-704-10
DISTRIBUTOR UNIT DS-610		
MAIN BOARD	66P3950	001-090-660
I/F BOARD	66P3951	001-090-650
CONT BOARD	66P3952	001-090-630
ZNR BOARD	66P3953	001-090-610
TRANSCEIVER UNIT DS-620		
MAIN BOARD	66P3960	001-097-930
TX BOARD	66P3961	001-090-720
PWR BOARD	66P3962	001-090-690
FIL BOARD	66P3964	001-090-700
JUNCTION BOX DS-640		
JTB BOARD	66P3970	001-090-800
JUNCTION BOX DS-645A		
JTB BOARD	66P3970 (LF)	001-083-610
JUNCTION BOX DS-645B		
JTB BOARD	66P3970 (LF)	001-083-610
REMOTE CONTROLLER RD-501, DIMMER CONTROLLER RD-502		
RMT BOARD	26P0012	001-076-930

Parts Location

Display Unit DS-600

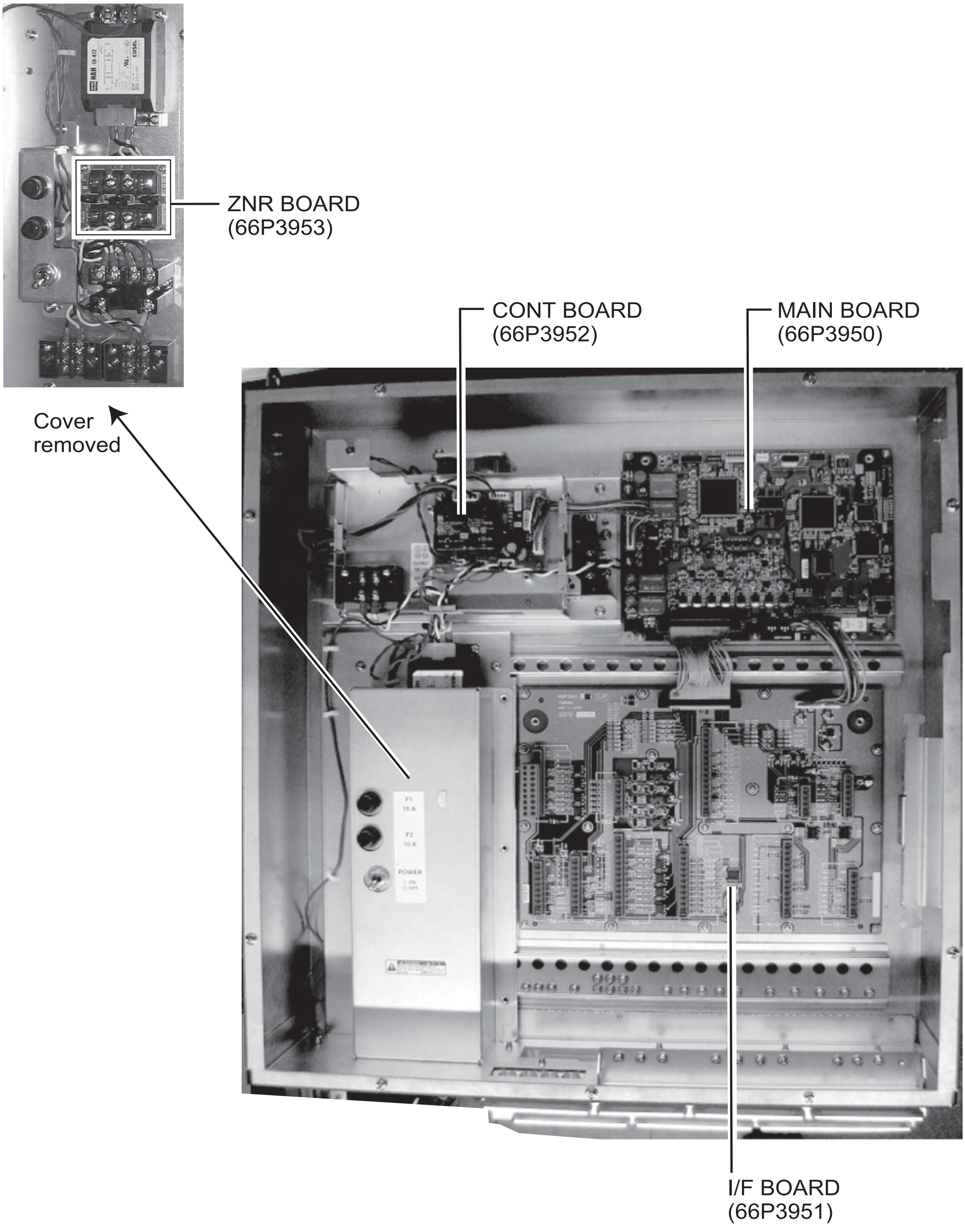


Display Unit DS-600, front panel assembly



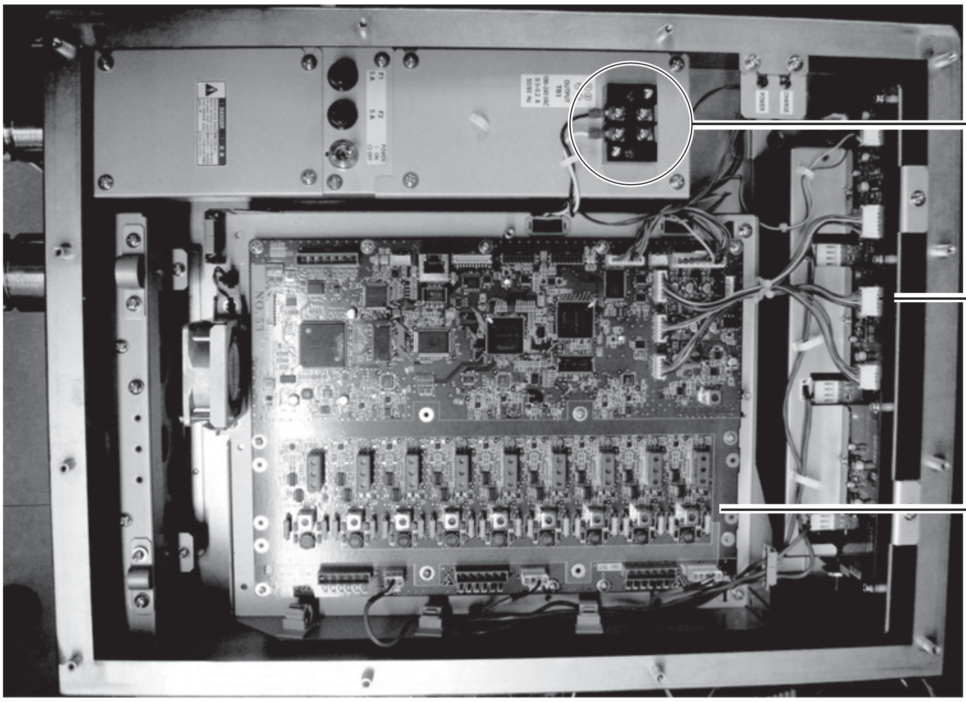
Display Unit DS-600, rear panel assembly

Distributor Unit DS-610

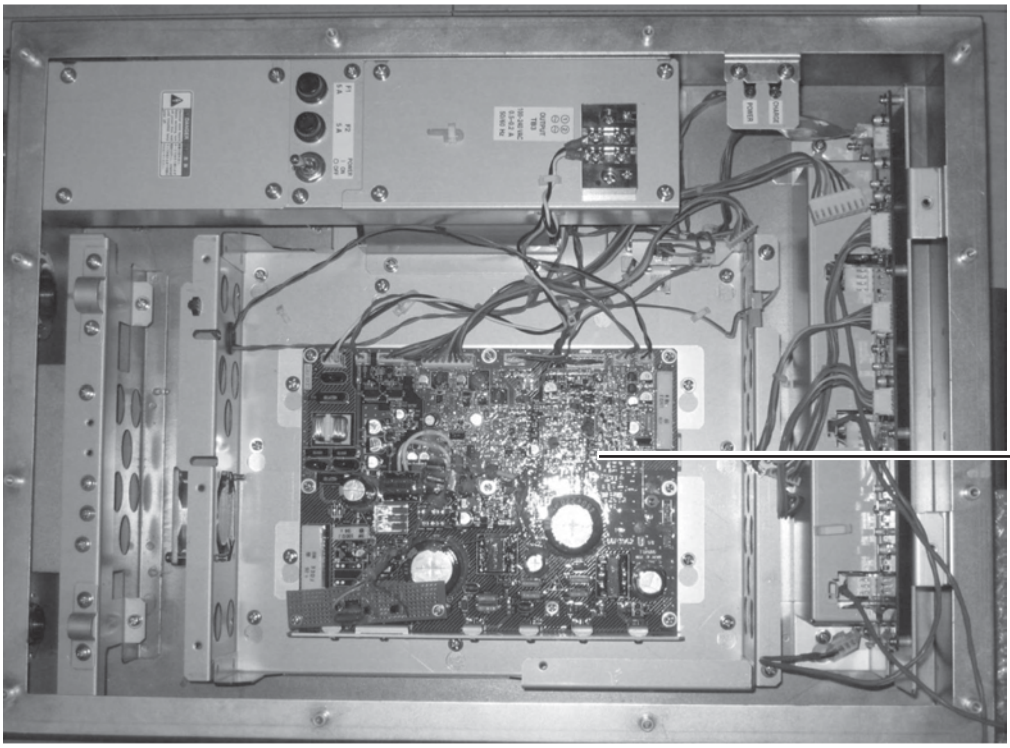


Distributor Unit DS-610

Transceiver Unit DS-620

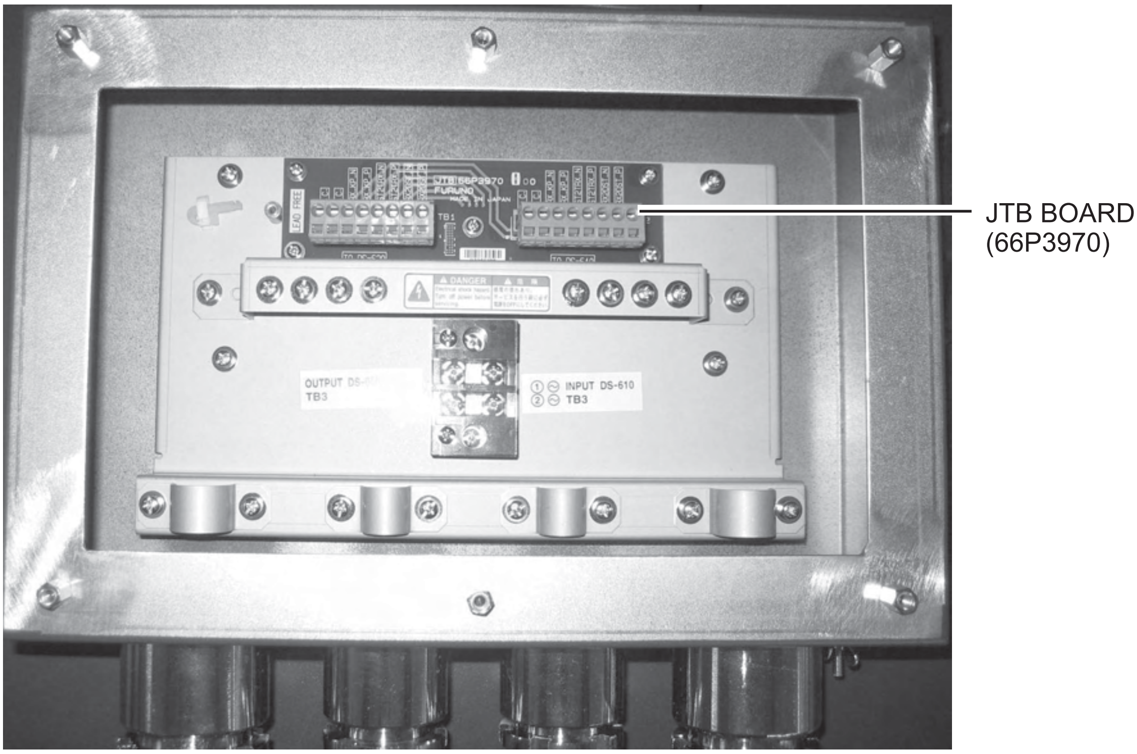


Transceiver Unit DS-620



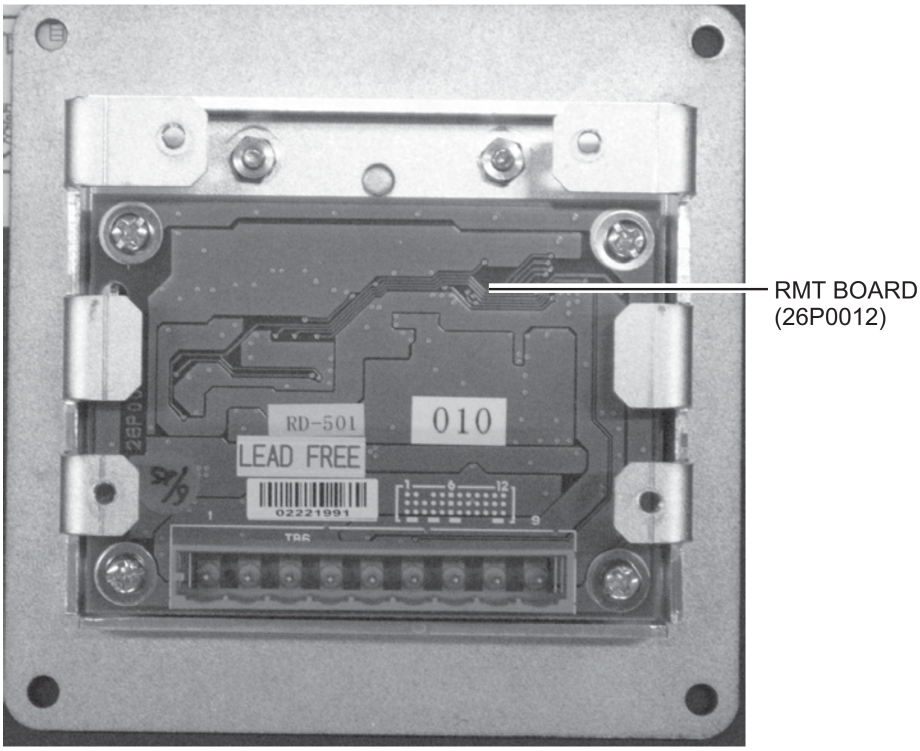
Transceiver Unit DS-620, MAIN BOARD (66P3960) removed

Junction Box DS-640



Junction Box DS-640

Remote Controller RD-501, Dimmer Controller RD-502



Remote Controller RD-501

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SPECIFICATIONS OF DOPPLER SONAR DS-60

1 GENERAL

1.1	Transmit frequency	320 kHz
1.2	Number of beams	3 beams
1.3	Ship's speed range	Fore-aft: -10.00 to +40.00 kn
		Port-stbd (fore/stern): -9.99 to 9.99 kn
1.4	Working depth*	
	SOG:	1 to 200 m below hull bottom
	STW:	0.5 to 25 m layer range, the area of sea as below;
		Ground tracking mode: 3 m depth or more
		Water tracking mode: 40 m depth or more
1.5	Total distance run	0 to 999999.99 NM
1.6	Accuracy	
	Ground tracking:	±1% or 0.1 kn, whichever is greater
	Ground tracking (<1 kn):	±2% or 0.01 m/s, whichever is greater
	Port-stbd speed at stern (bow installation of transducer):	
		±1% or 0.04 m/s, whichever is greater
1.7	Current direction/speed	0.0 to 9.9 kn, 360° (clearance required 10 m or more)

*: Working depth is influenced by conditions of installation and sea water. Water tracking accuracy may lower at the sea-bed depth 40 m or less.

2 DISPLAY UNIT

2.1	Main display unit	LCD, 640 x 480 dot (VGA)
2.2	Brilliance	0.2 to 500 cd/m^2
2.3	View angle	Up/down/left/right: 75° or more (color is not considered)
2.4	Dimmer	External dimmer control available
2.5	Backlight life	30,000 hrs approx. (+55°C)

3 INTERFACE

3.1	Input signal	Navigation data (IEC61162):	3 ports
		External keying pulse:	1 port
		Contact signal (alarm):	1 port
3.2	Output signal	Ship's speed (IEC61162):	5 ports
		Ship's speed (analog):	4 ports
		Distance signal (200 P/MN):	4 ports
		Keying pulse:	1 port
3.3	Input sentences	DBT, DPT, GGA, GLL, GNS, HDG, HDT, MWV, RMC, ROT, VTG, ZDA	

3.4	Output sentences	VBW, VDR, VHW, VLW, VTG

4 RATE-OF-TURN GYRO CONVERTER (OPTION)

4.1	Method	Optical fiber
4.2	Measurement range	Within ±5°/s
4.3	Light emitter's life	17,000 hrs approx. (+55°C)
4.4	Source	100-240 VAC: 0.15 A max, 1 phase, 50/60Hz

5 POWER SUPPLY

100-240 VAC: 1.6- 0.9 A, 1 phase, 50/60Hz

6 ENVIRONMENTAL CONDITION

6.1	Ambient temperature	
	Main display unit	-25°C to +55°C
	Others	-15°C to +55°C
6.2	Relative humidity	93% at 40°C
6.3	Degree of protection	
	Main display unit	IP56 (front panel)
	Remote display	IP22
	Transceiver unit/ Junction box	IP44
	Distributor	IP22
6.4	Vibration	IEC 60945

7 COATING COLOR

N2.5

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Declaration of Conformity

0735

We FURUNO ELECTRIC CO., LTD.

(Manufacturer)

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

(Address)

declare under our sole responsibility that the product

DOPPLER SONAR DS-60

(Model name, type number)

to which this declaration relates conforms to the following standard(s) or normative document(s)

IMO Resolution MSC.96(72)	IEC 61023: Ed.3.0: 2007
IMO Resolution MSC.191(79)	IEC 60945: Ed.4.0: 2002
IMO Resolution A.694(17)	IEC 62288: Ed.1.0: 2008
IMO Resolution A.824(19)	IEC 61162-1: Ed.4.0: 2010

(title and/or number and date of issue of the standard(s) or other normative document(s))

For assessment, see

- EC type examination (Module B) certificate No.BSH/4612/4071804/11 issued by Federal Maritime and Hydrographic Agency (BSH-Cert), The Federal Republic of Germany.
- EC quality system (Module D) certificate No. BSH/4613/02206/1602/10 issued by Federal Maritime and Hydrographic Agency, The Federal Republic of Germany.

This declaration is issued according to the provisions of European Council Directive 96/98/EC on marine equipment modified by Commission Directive 2009/26/EC.

On behalf of Furuno Electric Co., Ltd.

Nishinomiya City, Japan
March 10, 2011

(Place and date of issue)

Takahiko Kusuda
Manager, QMS Secretariat
Quality Assurance Department

(name and signature or equivalent marking of authorized person)